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for

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Industrial Medicine

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"I have been given my charge to keep—
Well have I kept the same!
Playing with strife for the most of my life,
But this is a different game.
I'll not fight against swords unseen,
Or spears that I cannot view—
Hand him the keys of the place on your knees
'Tis the Dreamer whose dreams come true!

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"Ask for his terms and accept them at once
Quick, ere we anger him, go!
Never before have I flinched from the guns,
But this is a different show
I'll not fight with the Herald of God
(I know what his Master can do!)
Open the gate, he must enter in state,
'Tis the Dreamer whose dreams come true! —KIPLING.

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The Law, the Science and the Economics of Industrial Health

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The Ambulant Treatment of Hernia

—*Opinions and Impressions, with Results to Date, Gained from Practical and Experimental Experience*—

by

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SO MUCH has been written on the subject of hernia that it seems as though the last word has been said. Yet when an analysis is made of statistics as to cure, there are differences in results that vary anywhere from 1% to 20%. A recent article by Bissel and Andrews states that the results in the surgery of direct hernia are so bad as to constitute a major surgical scandal, and further that when one considers that the recurrences are far more dangerous than the original hernias, it seems high time that the subject was thoroughly reconsidered.

Interest has been manifested at various times in regard to the ambulant treatment of hernia, but it has never become popular. As early as 1880, Billroth made the statement that if anyone could obtain a solution that would cause the artificial proliferation of tissue that would be as dense and tough as fascia, the radical surgery of hernia would be solved.

It is my object here to present opinions and impressions, with results to date, gained from experience with the ambulant treatment of hernia, practical and experimental, in cases treated at the University of Minnesota, together with private cases.

Various solutions have been employed in experimental work on dogs and rabbits, as well as in practical application to patients. Before treating any patients, colored novocain solution was used to inject the internal inguinal ring, and it was surprising to note how the solution could be deposited around the internal inguinal ring with the technique to be described. Thuja solution was the first used. Microscopical report of specimens after injections shows a marked proliferation of fibroblasts with these dipping down between the muscle fibres. This, according to Dr. Bell as he expressed it, produces a binding effect. There was no infiltration of polymorphonuclear cells, or any evidence of necrosis. Where the solution was injected into the peritoneal cavity, there was very adherent omentum, the fibroblastic tissue having completely obliterated the peritoneum. Loops of bowel were very adherent, but no obstruction was present. The formula and preparations will be given with the technique. Pina-Mestre solutions according to the formula given for Pina-Mestre solution, put up by a drug firm in this country, according to the formula given for Pina-Mestre solution, produced necrosis and so it was not used on patients.

With the original Pina-Mestre solution there was found a marked proliferation of fibroblastic tissue with foreign body giant cells. A solution consisting of a distillate of the tinctures reported to be in the formula for the original Pina-Mestre solution was used. To this was added tannic acid in standardized strengths, varying from .15 to 1%, as well as thymol .5% and benzol alcohol 3%. This produced a marked proliferation of fibroblastic tissue. The proliferation did not begin as early as that following the injection of the Thuja mixture, which could be seen as early as the fourth day. A number of dogs were injected using fluid extract pinus canadensis in alcohol and phenol, in strengths of 1%, 3%, and 10%. These are the basic drugs in Mayer's solution. They produced necrosis, abscess, and, in one dog, peritonitis and death. Pina-Mestre solution is supposed to consist of a group of vegetable tinctures which do not have a standardized strength of tannic acid, two of the drugs not belonging to the U. S. Pharmacopoeia. Several different strengths of an aqueous tannic acid preparation were used, the strength varying from .5% up to 5%. On account of the burning that results from the injection of an aqueous tannic acid preparation, various local anesthetics, novocain, nupercain and benzol alcohol were employed. This did away with the burning pain, but a large percentage of these patients would have symptoms of an acute coryza on the following day. This did not occur in all cases, but in so many that it was discontinued. This was

thought to be due to the fact that tannic acid did not exist in colloidal form in the synthetic preparation and was more rapidly absorbed, thus causing toxic symptoms. The proliferation of fibroblastic tissue is more marked than in the specimens following the injection of the distillate mixture. No giant cells were found. Sections where a tannic acid preparation was employed showed a denser fibrosis than sections with the Thuja mixture. Injection close to the peritoneum or just within the peritoneal cavity showed no evidence of abscess or necrosis, but a similar picture. The omentum was adherent to the abdominal wall, and there was so much proliferation of fibrous tissue as to completely obliterate the peritoneum. Results of injection below the fascia of dogs and rabbits showed a marked proliferation of fibroblastic tissue with no evidence of necrosis. There was no late necrosis or infiltration of polymorphonuclear cells. However, polymorphonuclear cells are present when proliferation is first noticed, which is about the fourth day. Sections from dogs injected with the original Pina-Mestre, as well as the distillate of the drugs contained in the formula, showed a reaction which could hardly be differentiated one from the other except that the section from the original Pina-Mestre solution showed better developed foreign body giant cells. There was no late infiltration of polymorphonuclear cells or necrosis in these specimens.

Fraser and Hall, at Bellevue Hospital and New York University, injected a few hernia cases in 1929, and carried out experimental work on monkeys and dogs. For this they used the Pina-Mestre solution. Their results showed a swelling and edema in 10 days. Examination of the indurated areas showed a vigorous proliferation of endothelial and connective tissue cells, plus large mononuclear phagocytes and foreign body giant cells. Two specimens showed trace of the injected substances in the abdominal muscle of the monkey and the omentum of the dog. In this latter, two sections of the tissues from the monkey showed an extensive mechanical rupture and necrosis of muscle fibres. There were masses of yellow granules engulfed by large multinuclear giant cells. It also showed marked proliferation of fibroblasts with some lymphocytes and plasma cells. There were a few areas of multinucleated regenerating muscle cells and single myelocytes. The omentum showed reddish granules and multinucleated giant cells, some single reticular cells and marked proliferation of fibroblasts.

There are several contra-indications to this method. All types of hernias are not amenable to this type of treament. Post-operative or incisional hernias usually have adhesions or incarcerated abdominal viscera and no definite sac and should not, as a rule, be so treated. Incisional hernias usually have one hernia that can be diagnosed, but have several potential hernias along the line of the incision. When there is a very small incision, and a definite opening can be determined, and the contents can be reduced and held reduced by a properly fitting truss, this hernia can be so treated. Hernia associated with an undescended testicle, or incarcerated or irreducible hernias should not be injected on account of the danger of strangulation. These are distinct surgical conditions. Hernias that can be reduced, but where the symptoms cannot be completely relieved by proper application of a truss, are surgical. Sliding hernias should not be so treated. It is very doubtful if a sliding hernia can be held reduced by a truss. To begin with, I was skeptical about treating direct hernias, but the results to date in direct hernias are just as good as in the indirect inguinal type. Any general surgical contra-indication, such as hyperthyroidism and hemophilia should always be considered a contra-indication.

Laying aside the contra-indications, we may state that any inguinal hernia can be treated provided that it is reducible and can be held reduced by a proper fitting truss, and provided there are no surgical contra-indications, as mentioned above. Although a few femoral hernias have been treated with good results, I believe that there are liable to be complications, especially in large hernias. Several epigastric hernias have been treated with good results. At the outset no umbilical hernias were treated, but with improved truss pads, they can be treated. Very often in femoral, umbilical or epigastric hernias, there is a fat pad in the sac. Application of a truss in these cases causes pain. These cases should not be treated unless there is absolute and complete relief of symptoms.

TO BEGIN this work, it is absolutely necessary to know how to fit a truss so as to hold the hernia reduced. In indirect inguinal hernias the pad of the truss should fit over the inguinal ring so as to hold the hernia contents within the abdomen. In direct hernias the truss pad should be fitted over Hesselbach's triangle, just above the pubic ramus. One type of truss will not fit all individuals. The best truss that I have yet found is a spring type of truss. When properly fitted, the patient can engage in almost any form of exercise or work he so desires. Trusses are usually fitted low, and very often give relief, but when so fitted they do not hold the hernia reduced except in direct hernias. They cause the hernia contents to press outward against the fascia of the external oblique and a resultant fraying or thinning out of the fascia as well as an enlargement of defect in the transversalis fascia. The spring type of truss is not always suitable for a patient with rounded or feminine type of hips. Here an ordinary elastic type of truss is satisfactory. The requirements are that the truss stays where it is put, keeps the hernia retained by a constant firm and continuous pressure and prevents protrusion of any abdominal contents. It is necessary to watch patients regularly to see that the truss fits, as a perfect fitting truss today may be worthless if a patient loses any great amount of weight. The measurement for the spring type of truss is taken about two cm. below the crest of the ilium, and bringing the end of the tape down to the symphysis pubis, or it can be taken directly around the body at the level of the buttocks. The two measurements are usually about the same. Cooperation on the part of the patient in wearing a truss is absolutely essential, otherwise failure is the result. Several cases have been successfully fitted with a truss, and treated only after having the patient on a reducing diet and thus reducing the intra-abdominal pressure. Reduction in weight in patients with hernias cannot be too strongly emphasized. Large scrotal hernias can often be held reduced after having a patient in

bed for several days with the foot of the bed elevated, and then treating the case daily for three days to a week. For umbilical hernias, the best form of truss is a hard pad which fits into the depression and is held in place with an elastic binder wrapped around the body several times. There should be two thin plates over the pad that fits into the depression. The first plate should come to the inner edge of the rectus abdominis muscle, and the outer plate should come to the junction of the outer and median third of the muscle. This is a definite improvement over any previous truss or binder used for this type of hernia.

THE objections which have been mentioned to this type of treatment should be considered. Paraffin injections can be dismissed without further discussion, for it is a well established fact that the method resulted in very few permanent cures. It caused irritation from the foreign body present, and required surgical interference for its removal and the closure of the hernia. The fact that it has been only in the hands of quacks is not a good argument, for it is not so many years ago that reputable medical men were severely criticized for the injection of hemorrhoids or varicose veins, and today they are both accepted and recognized. The so-called Timmerman treatment by alcohol should be discarded on account of the large number of injections required, and the fact that numerous complications have resulted. The fact that irritating solutions cause discomfort and pain sufficient to cause patients to be incapacitated, has not been substantiated. It is true that some cases will have a greater reaction than others, but very few cases suffer sufficiently to incapacitate them from heavy work. Another objection is the fact that a truss must be worn for a long period of time. A properly fitting truss is of no more inconvenience than a good fitting glove, after the first few days. I think it can be safely stated that 80% of all hernia cases are wearing trusses at the present time, and that only one out of 10 trusses holds the hernia properly reduced. It has been stated that this is a blind and not a rational procedure. To that I may reply that there is a definite technique and unless this is learned, great harm may result. This cannot be too strongly emphasized, as will be seen later on in this discussion.

A number of complications have been mentioned: hydrocele, epididymitis, sepsis, strangulation, sterility, peritonitis and abscess. There has been swelling of the cord in a few cases, and this has usually occurred toward the end of the treatment, but has caused no serious disability. Only rarely can fluid be aspirated from a hydrocele of the cord. This will be absorbed and will cause no serious result. Only an occasional case will suffer sufficient reaction to incapacitate the patient, and this is only for a few days at most. There has been no atrophy of the testicles noted at this date. Whether this is going to be a later complication and result in sterility is going to be proved after a lapse of years. It is surprising how many cases of atrophy of one or both testicles are found present when these cases are first examined. I wish to mention two cases who had a hydrocele with their hernia. At the beginning of treatment, the fluid would gravitate into the abdomen when lying down. Both these cases had a 50% atrophy of the testicle when first seen. After application of the truss and treatment there has been no recurrence of the hydrocele, and one of these cases, when last seen, showed a 75% normal size of the testicle. Another argument is that there is not a strong abdominal wall. A number of cases treated have developed hernias on the healthy side after cure was effected on the diseased side. It has been noticed that there is absorption of some of the fibroblastic tissue with time, in some cases. This is more likely to occur in patients with loose flabby tissues. The time elapsed since commencing this treatment is too short as yet to arrive at any definite and final conclusions as to this.

One case that was treated and about a year later died of an attack of influenza, was autopsied by the pathologist at the Midway Hospital. This showed a perfect closure of the internal ring and inability to even force a finger through this region.

Another case where there was some question about the contents being completely reduced after the second treatment, was operated upon. He had received one treatment at the internal ring and one treatment at the external ring. At operation, the sac was completely obliterated and was not found. One of my first cases had a partial paralysis of the anterior crural which was very temporary. After his arrival home from the office, he complained about weakness in standing and the tendency for his leg to draw back and upward. When seen in about one hour this had completely disappeared and he was working at his usual occupation in a few hours. Thuja solution was used in this case. Correspondence with physicians gives three cases with a similar reaction, one of which has a slight atrophy of some of the muscles in the anterior crural nerve distribution. In my case there was no permanent anesthesia, epicritic or protophatic.

Another case had a hyperesthesia of the thigh which lasted four weeks. Two cases were seen in consultation that had been injected with the Thuja solution. They had severe pain near the parumbilical point on the same side. This was followed by discoloration of the skin and a slough in one of the cases. I believe this resulted from injection of the mixture into the deep epigastric artery, causing complete obliteration of the terminal distribution of the vessel so completely that collateral anastomoses could not be re-established before necrosis began. Had attempt at aspiration been made before the injection, I feel that this complication would never have resulted.

One of our own cases was operated upon after the injection of Proliferol. He had severe abdominal pain the evening after injection. Operative findings showed no evidence of peritonitis or infection of any kind. The hernia was repaired, and the post-operative course was uneventful.

Occasionally a case will have pain as soon as injection is commenced regardless of whether it is below the fascia or in deeper structures. If this happens the injection is stopped. The pain has never continued for any great length of time.

A few cases have had general abdominal pain, but it has resulted in nothing serious. This has continued from a few minutes to as long a period as a day, in one case. I believe some of the fluid entered the peritoneal cavity in this one case.

There have been only two subcutaneous abs-

cesses, neither of which caused incapacitation for more than a few days. One developed in a case that had a severe flare-up of "athletes itch," two weeks after the last treatment. The flare-up of the "athletes itch" began with an attack of influenza. The other case began immediately. Here I believe the solution was injected into the subcutaneous tissues.

One case treated elsewhere, died at the University Hospital. Sixteen minims of Thuja solution had been injected in this case. It resulted in a perforation of the ileum, with resultant peritonitis and death.

Thuja solution, seems to give better and quicker results than any of the solutions alone.

THERE are several advantages to this form of treatment, the principal one being that it is ambulatory and that the patient continues working, and is not confined to the hospital for a period of two weeks, and is not incapacitated for another period of four to eight weeks. There is no question but that the economical issue is of greatest importance at the present time. To illustrate this, I am going to cite one case. It was that of a man 67 years of age, suffering from a bronchial

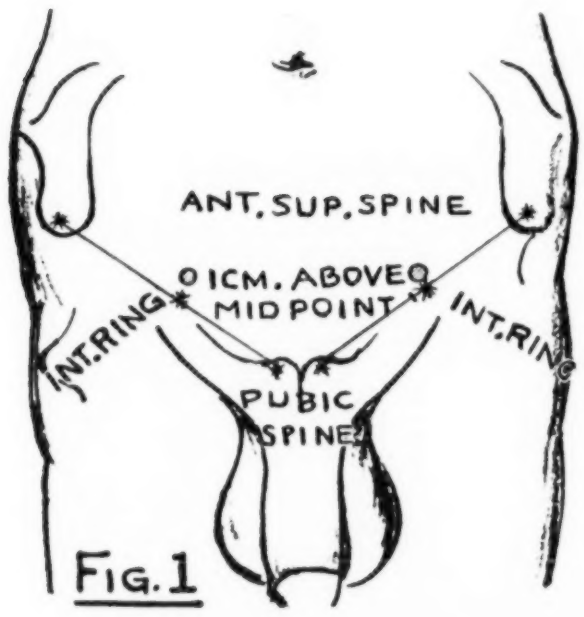


FIG. 1

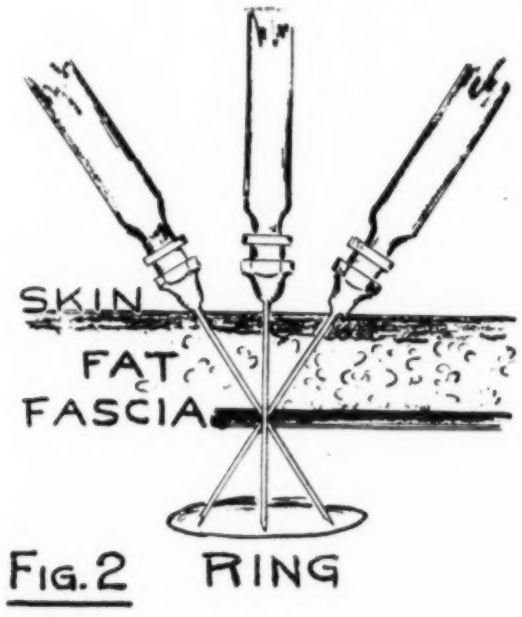
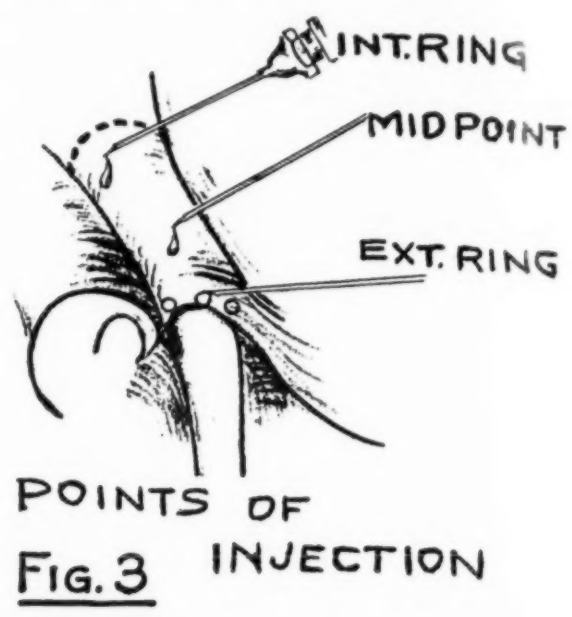


FIG. 2 RING



POINTS OF INJECTION
FIG. 3

Fig. 1 sketches the location of the internal inguinal ring, which is approximately 1 cm. above the midpoint between the anterior superior spine of the ilium and the spine of the pubis. This varies according to the size of the hernia, so that in a very large inguinal hernia, where the defect in the transversalis fascia is greater, the ring will extend lower. This location is above the line between the two spines and not along the line.

Fig. 2 shows the injection of the internal inguinal ring. The needle is introduced directly through the skin, fat and fascia of the external oblique muscle. As the needle penetrates the fascia, there is a distinct "give" feeling. Very little experience is needed to determine this location. As the needle is introduced slightly further, depending upon the thickness of the abdominal wall, it will approach the region of the internal inguinal ring. When the needle is in the proper location, the syringe can be rotated in a circle, thus giving free rotation of the tip of the needle. This can be very easily demonstrated by the injection of colored novocain solution, preparatory to operating upon a hernia.

Fig. 3 shows various points for the injection along the inguinal canal. The solution should always be deposited below the fascia and not superficial to the fascia. Several points should be injected, as per sketch, at the external ring. The needle point should be within the external ring so that none of the solution filtrates into the subcutaneous fat, as, when this happens, there will be a hard nodule present. The needle should not go so deep as to injure the cord.

The course in cases treated after injection shows an induration in the region of the injection. This is usually tender to pressure on the day following treatment. Usually after two to four treatments there is sufficient exudate or plastic tissue formation to prevent protrusion of the viscera even without the truss. There have been a few cases where a swelling of the cord resulted, but this usually subsided in a few weeks. Hot packs relieve the pain when present. The external ring shrinks in size and the fascia can be felt to thicken, so that at the end of a few weeks the external ring will not admit the tip of the index finger. This usually begins after two injections at the external ring. Cases where an aqueous solution of tannic acid mixture was used, would often complain of general malaise or chilly feeling as if they had a cold, on the following day. Practically all patients mention the great relief obtained as soon as they are fitted with a truss and have had two or three treatments. There is less soreness and pain from the distillate mixture, Proliferol, than from either the Thuja or Mayers solutions, and this, used in conjunction with the asthma and hypertension. He had had several recurrences following surgery, and was wearing the fourth unsuccessfully fitting truss. There was a large ulcer in the groin. This was a complete total permanent disability case. He was put to bed with the foot of the bed elevated, and given daily injections for five days. He returned to duty on the seventh day, and has continued at his employment without losing any more time. At the present time he has a very good result, but he has been advised to always wear his truss when he has a bronchial cough. There is no question but that the recurrences of hernia following surgery are much greater than statistics show, for hernias will recur, or a new hernia develop, as long as 15 to 18 years after the operation, and it is most difficult to obtain a check for an accurate percentage of recurrences. I do not believe that the recurrences will be as high with this type of treatment as they are with surgery, and especially so if the cases are watched every two months for a period of two years. However, the incidence of recurrence is higher than given by the men who have reported this work in the medi-

cal journals. A number of surgical cases that began to show weakening and beginning recurrence, were fitted with a truss and treated, and recurrence of the hernia was prevented. I believe that the recurrence of hernia following operation can be practically prevented, provided that the patients are fitted with a truss and compelled to wear it for a period of time after operation. The case should be supplemented by injection treatment if there is any suggestion of recurrence.

THE technique is not difficult when the anatomy of the parts is known. After the patient has been fitted with a truss, and this has been worn for a period of several days to a month, so as to be certain that the truss fits the individual, and holds the hernial contents reduced, treatment can be started.

Pina-Mestre solution is reported to consist of several vegetable tinctures, the basic drug being tannic acid.

The distillate mixture which is labeled Proliferol is a distillate of several vegetable tinctures to which tannic acid has been added, in strengths of .25% to 1% tannic acid.

The technique for treatment where the Thuja mixture or Mayer's solution is used, is to begin with two to five drops of Thuja mixture, injecting at the internal ring as described in the sketch. Injections are made about twice a week, depending upon the reaction of the individual. Should there be much reaction, then the duration of time between the injections is lengthened. After several injections in the internal ring, there is usually sufficient plastic exudate so that the hernia does not come down, even when the truss

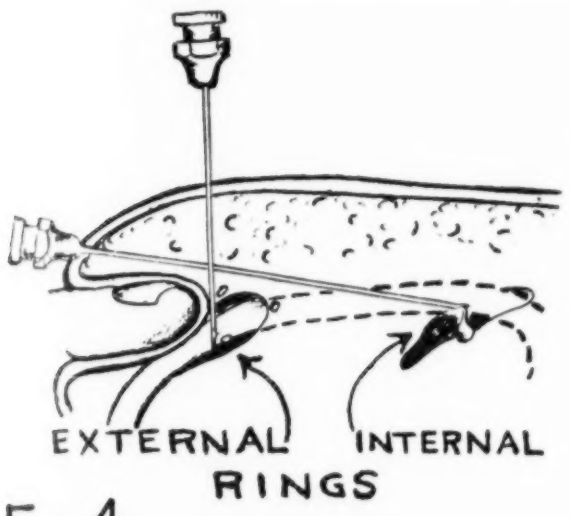


FIG. 4

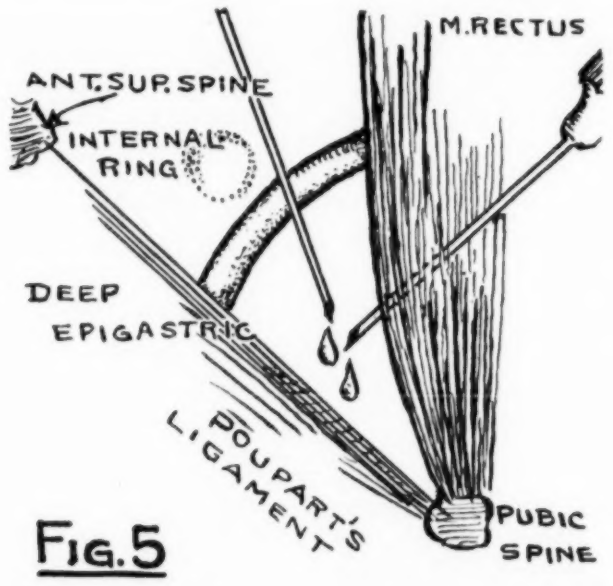


FIG. 5

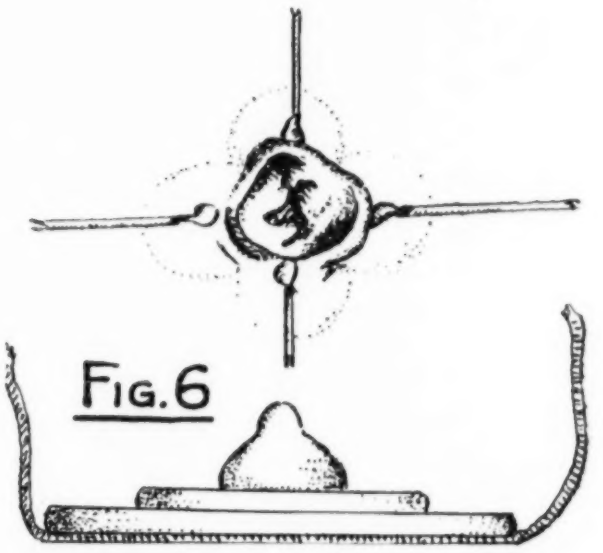


FIG. 6

Fig. 4. The internal ring can also be injected by introducing a three-inch needle through the external ring, and passing it forward along the inguinal canal to the region of the internal inguinal ring. After passing the external ring it is carried forward to about one and a half to one and seven-eighths inches. There is, however, more danger of injuring the cord with this technic.

Femoral hernias can be injected very easily by placing the tip of the finger in the femoral canal, and then injecting the solution immediately below the tip of the finger. Not over two or three drops should be injected at one time in femoral hernias. As a rule, not over three or four injections are necessary to obliterate a femoral hernia.

Fig. 5. The technic for the injection of Hesselbach's triangle. In the case of direct hernias the needle can be slid along the outer edge of the rectus abdominis muscle or can be entered into the triangle lateral to the rectus abdominis from above. In this manner the triangle can be injected without injury to the cord.

Fig. 6. Method of injection of umbilical hernias. Novocain should first be used as injected in inguinal hernias, only in a smaller quantity. Not over 1 to 1.5 cc. should be injected at a time at various sides of the hernia. The needle should reach down to the edge of the fascia. Also cross-section of an umbilical pad, showing cone-shaped truss pad which fits into the hernia opening and then two pads which support this. After this pad is put in place, it is held by an elastic bandage wrapped around the abdomen several times.

The formulas for solutions which we have been using to date are as follows:

Thuja mixture:

Phenol	50 parts
Alcohol	25 parts
Lloyds Specific Tincture of Thuja	25 parts

Allow to stand two days and then either decant or filter.

Mayer's solution:

Zinc sulphate	1 dr.
Phenol crystals	6 dr.
Glycerin	4 fl. dr.
Aq. Cinnamomi	1 fl. oz.
Fl. extr. pinus canadensis (dark)	5 fl. dr.
Sterilized chemically pure redistilled water	2 fl. oz.

Dissolve the zinc sulphate in the cinnamon water. Liquefy the phenol crystals by heating. Add the glycerin. Shake thoroughly until mixed and cooled; then add the distilled water and finally the fluid extract of pinus canadensis. Shake thoroughly. Allow the fluid to stand for about a week, agitating the mixture several times a day. Subsequently it should be filtered. Before injecting, boil the solution in a glass tube.

is removed. After beginning treatment the patients are advised to wear the truss day and night for at least 30 days, or until such time that it is certain that there is sufficient organization to hold the hernia contents within the abdomen. Injections are also given at several points along the hernia canal, just beneath the fascia. Injections are also given just inside the external ring, and also in Hesselbach's triangle. For the injection of Hesselbach's triangle, the needle is introduced inside of the cord and posterior to it, depositing the solution upon the conjoined tendon or the transversalis fascia.

The type of syringe most satisfactory is the ordinary insulin or tuberculin syringe with a size 22-gauge needle. For the Proliferol solution, a five cc. syringe is the best.

The Thuja solution can be injected usually to a quantity of eight drops, whereas with the zinc sulphate solution two to six drops is usually sufficient. The number of injections required to

close the hernia varies. A few cases have received only four treatments, and had a good result. As many as 20 injections have been given to cases with large scrotal hernias. It is much better to give more treatments and be sure of a good closure. There is more reaction or soreness with the Thuja solution or Mayer's solution than with the Proliferol solution. However, the Thuja solution produces more proliferation than the other solutions.

With the distillate mixture, or Proliferol, the treatment is started at the internal ring. The technique has been changed with this, as we gained more experience and knowledge of the subject. Injections are started at the internal ring as described in the sketch. First two cc. of 2% novocain solution without adrenalin are injected at the site to be treated. The needle is left in place for several minutes before the Proliferol solution is injected. Aspiration should always be attempted before any injection is made, so as to be sure that no blood vessel has been entered, otherwise complications may result. No more than two or three cc. of the solution should be given at the first treatment, and where the stronger solutions of Proliferol are used, not over three to five cc. should be used at any time. Injections should also be made at the external ring and along the canal below the fascia so as to completely close this. Also Hesselbach's triangle should be treated in all indirect inguinal hernias, so as to protect against a direct hernia. It is preferable to treat these cases every other day or twice weekly, although they can be treated daily with good results. There is much less after pain or soreness with this solution than with the other solutions. The treatment should be continued until the entire inguinal canal is filled with a plastic exudate which becomes indurated and hard, and until no impulse is present. It is not advisable to have the patient strain and cough until it is fairly certain that the hernia is obliterated. Occasionally there will be swelling of the cord, but this does not contra-indicate treatment at that time. The swelling always subsides in a few weeks. In direct hernias the region of the internal inguinal ring should be injected to guard against development of an indirect hernia. Where there is a very large external ring, Thuja solution is often used in combination with the distillate mixture. Here the region of the internal ring is injected with the distillate mixture and the Thuja solution is injected at the external ring below the fascia. At the next treatment, the Thuja solution is used at the internal ring, and the distillate mixture at the external ring. Only half the usual amount should be used when treating in this manner. About one treatment with the Thuja mixture to three or four of the Proliferol seem to give better results than either alone. Should the case not respond to treatment, then a few drops of Thuja mixture are mixed with not over two cc. of Proliferol.

A RECENT check up of cases show 707 hernias treated. About 10% of these cases are direct inguinal type. Umbilical and femoral hernias are included in the list. The recurrence of hernias following operation is running lower than at our first check up, but it still shows 17% recurrent hernia after operation. There has not been a single recurrence after the injection treatment that even approached the size of the original hernia. Where cases have needed more injections as a result of impulse being present, these cases have been listed as recurrences. These should probably be classed as incomplete closures. At the present time this runs slightly above 7%. There have been only nine cases where a closure could not be obtained. These were cases where surgery was advised, but refused. However, quite a number of cases are under treatment and still wearing a truss, so statistics at this time are not of much value. If recurrence, after five years, can be kept down to anywhere from 10% to 20%, I feel that it will be very good, when one considers the types and size of hernias that we are treating, as well as a number of cases where surgery is contra-indicated, i. e. cases of bronchiectasis, chronic bronchitis, asthma, hay fever, and coronary disease.

The following instructions are given to every case in regard to essentials in treatment:

1. The truss should be worn next to the body, removed in bed, and put on in bed.
2. All patients should wear their truss night and day for a month after treatment is finished.
3. If the truss does not stay in position, a strap fastened in front and back will hold it in place.
4. The pressure of the pad should produce a depression in the skin.
5. If the hernia becomes painful, or if you are distressed by wearing the truss, report to the clinic for examination.
6. The hernia must be held back at all times by the truss.
7. You will be able to continue your regular occupation, but if you do any heavy lifting, see that the truss is in proper position.
8. The number of injections varies from eight to 16.
9. The truss should be worn six months after the last injection.
10. At the end of this period return for check-up.
11. It is also well that you report for examination every two months for about two years.
12. If at any time a recurrence develops, we would appreciate it if you would return for examination, or notify us to that effect.

IN CONCLUSION: As to the ambulant treatment of hernia:

1. It is a safe and effective method in eradicating certain types of hernias, if proper technique is used, but there is danger of complications if details are not adhered to.
2. It demands the cooperation of the patient in the proper wearing of the truss.
3. Knowledge of the fitting of trusses and the technique of the injection is absolutely essential.
4. Recurrence of hernia can very nearly be done away with by combined form of treatment.
5. Patients who are incapacitated and have definite surgical contra-indications, can be so much relieved as to pursue a gainful occupation, and in many cases a cure can be effected. Complications as mentioned have not been substantiated to date by clinical cases.
6. It brings the mechanical treatment of hernias, where necessary, from the hands of those who know little or nothing of diagnosis, pathology and anatomy, into the hands of physicians who should know this form of treatment.

The Treatment of the Neuroses

—*Associated with Trauma*—

by

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IN AN earlier publication[1] it was proposed that the term "traumatic neurosis," euphonious and entrenched though it was, be replaced by the phrase "neuroses associated with trauma." The suggested name embraced a wider concept and was unprejudiced as to causal relationship implied in the older designation. Under the new heading, there was a subdivision into several groups, the classification based upon the dominating causative factors. Patients suffering from such neuroses are not all of one type, but should be placed into separate divisions: "Injury," "Industry," "Indemnity," and "Inherent." These subdivisions are reviewed here because the treatment may vary fundamentally for patients in different classifications.

To outline the treatment appropriate for the various types of patients is the aim of this paper.

Prevention

THE doctor who treats the chronic case is confronted by so many obstacles, medical, financial, and legal, that prevention demands first consideration. Physicians must support the programs of safety engineers to reduce the incidence of trauma in industry; they must support or initiate movements to reduce the epidemic of killing and maiming by automobiles; they must lead the campaign against driving by the seriously handicapped, the intoxicated, and those who confuse "the right of way" with "the right to slay."

Physicians have an important role in advising industry to offer a more helpful share to the employed, for the incidence of neuroses bears an inverse ratio to the interest in the work. (The cause is industrial rather than medical—from Slater[2].) The importance of conditions at work is likewise strongly emphasized by Eliasberg[3], who wrote a scholarly section on treatment in Riese's Monograph, "Unfall Neurose." Indeed, Eliasberg intimates that the social and economic conditions of the working man are of vital importance both in the cause and in the cure of such neuroses.

These points in prevention are not always within the scope of the physician, and we can but touch upon them sketchily, to attend in greater detail to the more practical problems of treatment.

Treatment in the Initial Stage

THE physician who sees the patient in the emergency ward and in the earliest days after an injury must consider the patient's mind to some extent along with the greater attention given to morphology. And just as it is important to evaluate the possibility of infection (say tetanus) and to guard against it, so too a little thought may be directed to the possibility of a neurotic reaction and to an attempt to guard against it.

The most important procedure, too well known to need emphasis, is a thorough examination. Thoroughness early will serve many purposes: (a) It will contribute toward a clear diagnosis and appropriate surgical treatment. (b) It may help gain the patient's good will, help establish a friendly rapport. (c) It will afford some insight into certain significant mental reactions: The patient's attitude to the physical changes produced by the injury (his "credo"), his attitude toward the cause of the injury (self-blame, accusation of others, desire for revenge, demand for compensation); and lastly his interpretation of the event (luck and fortunate escape, misfortune, guilt, etc.)

The physician is often in an important position of leadership. He may happily guide his patients toward recovery or unfortunately misdirect them into a long period of neurotic invalidism. The medical man who learns the patient's "credo" can, by reassurance, relieve him of many alarming fears; who knows the patient's rising antagonism may possibly minimize it or convert it into more useful channels than revenge; who understands the superstitions and fears may replace them with a more normal, courageous outlook; while the doctor who adds to the possibilities of trouble by a report, an exaggerated statement, who arouses antagonism for revenge and who stimulates a fight for compensation may inadvertently encourage a long chronic illness (Iatrogenous neurosis—Bleuler[4]).

The need for early treatment is imperative because in the developed state the neuroses of trauma are more complex than most illnesses. The popular comparison between illness and warfare has its truest expression in such neuroses. The patient often finds himself in a campaign against an adversary (his former employer, an insurance company, a corporation). Allied with him are his lawyer who may be compared to Minister of War; the doctor who corroborates his case is his General; the soldiers are the symptoms. New soldiers responsive to the call to arms join the veterans to overcome the enemy. In the enemy camp are the adjuster, the company doctors, the industrial commission, and the corporation. That this parallel is not overdrawn may be inferred from the following observations and remarks. There are peculiar symptoms which can be understood only as proof of disability. Such symptoms are rarely given up (disbanded) until the case is settled (peace reached). The company doctor, however able and fair he may be, is suspected and distrusted; often the "lawyer-sent" doctor, whose reputation may or may not be high, is respected. Such patients save all their papers and make notes of the statements by physicians. Their attitude toward the illness and the recovery is sometimes revealed in such a phrase as, "Doctor, if you cure me I will lose my case," "I am battling for my compensation," "I will fight them in every court until I win."

The aim and duty as to early treatment is clear. A thorough physical examination, an interest in the patient and his problem, appropriate comments, and reassurance are needed. Unfortunately this is not always feasible; the patient may resent and refuse such interest, or the doctor may not be in a position to carry out such treatment.

Back Injuries—Special Group

I WILL diverge from the main theme to stress a particular group of patients; namely, those suffering from back disorders of psychic origin. In the past three decades medicine has developed an integrated view of the patient as a whole. Through several nerve pathways, it has been shown how the emotions are physiologized and expressed through disorders in one or many visceral systems. Such conditions as cardiac neuroses and gastric neuroses are well recognized and readily diagnosed.

Less attention, however, has been given to such conditions as "vertebral neuroses." The psychic background of seemingly somatic back symptoms has been neglected. Just as patients may express dissatisfaction with life, jealousy, hate, and fear through changes in visceral organs, so too alterations in muscle tone of the paravertebral columns, peculiar back pains, and abnormal postures may result. The emotions behind such phrases as "I cannot bear it," "I will not carry on," or "The load is too heavy" may be precipitated into local pathology of weakness or stiffness of the back. Not uncommonly, peculiar gaits and postures, muscle spasm, and stiffness, seemingly clear cut evidence of organic disease, are shown to be the somatic expression of an injured psyche. Insufficient attention has been pain to "spinalgias" of psychic origin.

Within the past year I have seen not a few examples of what might be called back disorders of psychic origin. Such patients complain of pain, weakness, and stiffness. They present rigidity of the spine and peculiar postures, which are seemingly corroborated by x-ray evidence of hypertrophic changes in the vertebrae. This combination at first suggests an organic lesion. However, further study into the life problems of the individual may reveal personal, familial, or occupational maladjustments, and the functional nature of the symptoms is proved by cure through psychotherapy. *One must investigate the background as well as the back.* The following example will illustrate this group:

CASE 1: Miss M. M., aged 34, a divorcee, had been working as a waitress in a restaurant. One day she slipped down the lower half of a stairway and struck her back and left hip against the sharp edges of several steps. She developed pain in the left hip, radiating down the left leg, and pain in the back. The earlier treatment was unsuccessful. Miss M. M. consulted an osteopath who gave her numerous adjustments without avail. X-rays were there taken and showed a lumbar scoliosis and a slight hypertrophic change in the vertebrae. An experienced orthopedic surgeon found muscle spasm and marked limitation of motion in the lumbar region and pelvis. He advised a fusion operation, which the patient refused. For three years Miss M. M. had been going about with a peculiar, limping gait, her back curved and stiff.

The patient was referred by the Industrial Commission for study. From the standpoint of psychotherapy, her confidence was gained, her life history investigated, her mind was relieved of the fear of crippling arthritis, and it was then decided to try the effect of suggestion. This was done through the medium of a lumbar puncture. Within a week the pain was relieved, the scoliosis disappeared, and the patient has been able to walk perfectly erect.

Treatment

SPECIAL Procedures for Each Classification. For the patient with an established (chronic) neurosis, the treatment will depend upon (a) the individual, (b) the coexisting organic changes, and (c) the experience and attitude of the physician. The treatment of course should be individualized, for the neurosis represents the patient's personal reaction to life and therefore varies with each patient. The basic defects prior to or produced by the injury must also be attended to.

For patients in Group I, where the symptom complex is the end result of physical or physiological cerebral disturbance, the therapy should include (a) measures favoring dehydration to reduce edema in the early stages, (b) phenobarbital, grains one-half to one and one-half, t.i.d., to reduce vasomotor instability, (c) strong sedatives for sleep if needed, and (d) protection against unpleasant irritation, both physical and social. Especially important are outdoor exercise with long intervals of rest, and avoidance of alcohol. For those who continue to suffer from headaches and dizziness, which have persisted in spite of the above measures, encephalography may be tried. This new measure of replacing cerebrospinal fluid with air is credited with separating arachnoidal adhesions. This procedure has been found useful therapeutically (Penfield[5]).

CASE 2: E. L. had been struck on the head with a pistol and was rendered unconscious. After recovery from this initial period, he was disturbed by headaches, dizziness and photophobia. Later he developed irritability, was subject to temper outbursts, and developed temporary amnesia. There were certain attacks in which he fell and had convulsive seizures. An organic neurological examination was negative. Encephalography was done, primarily to rule out a subdural hematoma. The x-ray pictures were negative, showing no deformities of the ventricular system.

The therapeutic result was marvelous. The headache cleared and after some days the patient left the hospital considerably improved. He has been successfully employed for three years following the encephalography.

For patients belonging to Group II, chief attention must be given to the work situation. If the occupation is dangerous and the patient's neurosis represents a flight from this danger, it is futile to force him back to it. Schaller and Somers[6] have observed that in some patients the illness develops when the physical changes have healed and the individual should be ready to work. In such circumstances, either entirely different employment should be offered, or the same work in a different environment or different altitude. If a patient desires to return to work early, this should be encouraged, but it has been found unwise to compel an individual to hurry back to work before he feels recovered.

A case history which I have reported earlier (Fetterman[7]) is that of B. W.

CASE 3: B. W. was an able-bodied, healthy young painter who had loved his work and had no fear of height. One day the scaffold on which he was standing gave way and he fell some 16 feet to the ground. In this fall he sustained several fractured ribs. During the weeks of his convalescence his anxious wife hovered protectingly over him. "Ben, dear, you must be more careful. You were almost killed and I might have been a widow. Dear Dad died from a blow on the chest. Oh, dear, do be careful." In the course of six week the fractures were well united, the pain had ceased, and B. W. announced himself ready to return to work. His company had finished the job on which he was working and had just started painting in the Cleveland Public Hall. The first assignment given to B. W. was to paint the ceiling of the main auditorium from a scaffold some 80 feet above the ground. He began bravely, but his arm fatigued somewhat from the overhead painting and, as he paused to rest, he looked at the floor 80 feet below. The memory of his wife's admonition caused a shudder to go through him. He could see himself a heap of bones if he made a misstep. His arm trembled and ached. After some futile attempts to paint, he complained to his foreman of the weakness and trembling of the arm.

He was referred back to his physician for these symptoms and a diagnosis of brachial neuritis was made, a neuritis attributed to the fall. The patient received compensation and was treated for a year. After this long interval without recovery he was referred to me for study.

A complete neurological examination showed the contour of the right arm symmetrical with that of the left; the muscle tone was excellent and the reflexes were normal. All sensory responses were negative. A superficial psychiatric study disclosed the obvious meaning of the symptoms. B. W. was afraid of the height, but used the physical symptoms of pain and weakness explained by the word neuritis as a means of escaping with honor. The meaning of the symptoms was explained to the patient and he was advised to seek ground floor work. Within a week he was swinging a brush happily when his company offered him work on the main floor.

A change in type of work is not always possible. What can be done for miners who have developed a neurosis from injury, or a window cleaner who, following a fall, fears to stand on a ledge, only industrial engineers can say. Such patients will fight against return to their type of work, and wage their fight with symptoms. A change in the type of employment should be arranged. Type II represents a labor and not a love-linked neurosis.

For patients belonging to Group III, motivated largely by an indemnity wish, treatment must accomplish two aims. The symptoms should not be over-emphasized by the manner of the doctor, by written statements, nor by accessories to the treatment. Litigation should be discouraged. A financial settlement terminating or preventing a combat for compensation should be encouraged. Such patients are often relieved by this so-called "gold cure," for the will to get well may be swept aside by the wish to get wealth.

For those patients classified in Group IV, the inherent or essentially neurotic individuals, the treatment is most difficult. It must not be forgotten that for these people the illness may be the solution for unconscious conflicts. Such patients often cling to their symptoms as though in secret league with them (Levy Suhl[8]). They blame the trauma, but it is not the cause of their illness; as pointed out in the original paper, the accident may be the result of the neurosis.

For patients in Group IV, as well as for patients in all groups, certain general measures are of value; psychotherapy, symptomatic treatment, and medicolegal adjustments.

Psychotherapy

EVERY little pill which a doctor gives, every prescription he writes, every word he utters, every move and gesture may have its influence upon the patient's psyche. The sum total of the influences for recovery constitutes psychotherapy.

Within the scope of the term psychotherapy, Menninger[9] enumerates some 14 procedures. These he subdivides into two groups; suppressive and expressive. The suppressive measures hide from the patient the true meaning of his illness and attempt to "cure" the patient through suggestion. Among the measures in the suppression group are hypnosis, persuasion, suggestion, reassurance, etc. In the expressive concept, the patient is urged to talk and thus to pour out his woes and sorrows in the hope of revealing the surface as well as the underlying causes of his illness. The expressive method may be an hour's heart-to-heart talk or may comprise "psychoanalysis," in which the patient reveals for an hour each day, from day to day for perhaps a year or more, his dreams, his infantile experiences and wishes, in the attempt to bring forth ideas repressed in the unconscious charged with pent-up emotional energy, which may be correlated with the symptoms.

From a practical standpoint, the average physician makes use of that form of psychotherapy appropriate to the patient, in which the doctor is most skilled. For one patient explanation and education are helpful. For another the confessional method is better. A third needs some "magical" method, achieved through lights, electricity, etc.

During the course of the past year, I have treated many patients suffering from neuroses associated with trauma. The therapeutic results of the chronic, deep-set cases are most discouraging. Nevertheless, from time to time it has been possible by the use of some of the above methods, to relieve many of the patients and to cure some entirely. In certain instances, there has been a prompt, complete cure as if by magic. Sometimes the cure has been so rapid as to surprise not only the patient but also the doctor himself. In analyzing a group of 10 such cases of neuroses (including hysteria) rapidly cured, I found certain interesting factors common to most of them. (a) In general, the symptom was limited to one region or organ (monosymptomatic); for example, hysterical paralysis of an arm or leg. (b) The patient was relatively young; nine out of the 10 were between 15 and 35 years of age. (c) The "purpose" of the illness had passed; the goal had been achieved; the *raison d'etre* was ended. (d) The patient was suggestible. (e) The patient had acquired faith in the man who was treating him. These five characteristic features are exemplified in the following case history:

CASE 4: A. B., a young man of 17, who gave a history of a psychopathic background and a fair I. Q., was struggling through high school against many obstacles. His clothes were shabby, he worked long hours for his room and board, and his scholastic record was border line. One day on the landing of a high school stairway he began a heated argument with a more popular classmate, which ended in blows. A. B. was punched in the face and fell or slipped down several steps. Immediately he became stuporous and appeared confused and dazed. He was sent to Lakeside Hospital emergency room and then placed on the ward. The drowsy manner and dazed state suggested the possibility of intracranial damage, perhaps a subdural hematoma. Thorough study and search were made for an organic lesion. There were several complete physical and neurological examinations, x-rays of the skull and spine, and spinal fluid tests, all of which were negative. For two or three weeks A. B. lay abed, apparently well, but when asked to stand or walk he collapsed to the floor.

The neurological consultation revealed an essentially negative status. The muscle tone and reflexes in the lower extremities were normal. Sensory responses negative. There was no evidence of intracranial lesion.

Inquiry revealed the patient's intense wish that the culprit be punished. The diagnosis of an hysterical gait difficulty, "astasia abasia," was made. In considering what would be the appropriate therapy, the young man's youth, the fact that the offending boy had already been punished at school, indicated that suggestion might be effective.

The patient was told that the high school had reprimanded the offender and that proper punishment was given him. A look of joy passed over A. B.' features. He was then reassured that he could be positively cured. I then applied some strong smelling liniment around the right leg and bandaged the right knee, with the reassurance that he would now be better. The young man was helped out of bed and announced that his right leg was strong but the left felt weak. I therefore administered similar treatment to the left leg. Within a half hour the young man stood well, walked around the room. On the following day he was able to run up and down the stairs with perfect ability and stated that he intended to train for the track team. He was discharged and returned to school. I have had occasion to see this young man on several visits to the hospital. He appears to be fully recovered.

The youth of the patient, his impressibility, the monosymptomatic character of the illness, and especially the termination of his revenge motive helped to obtain this prompt cure by suggestion. It is true that such treatment merely removes the symptoms and not the basic personality change which led to them. The latter is desirable but for numerous reasons not always feasible.

A second case history which likewise demonstrates the value of thorough study and of winning the patient's confidence and the achievement of a cure through suggestion is the following:

CASE 5: R. F., male, aged 34, farmer and married, referred by Dr. H. H. Dorr of the Industrial Commission of Ohio. The claimant had received an injury to the lower end of the spine which was complicated by an ischiorectal abscess. In the long interval during which the abscess drained, there developed incontinence of the urine and later numbness and weakness of both lower extremities, but when the abscess healed the symptoms in the legs grew worse. There was gradual loss of feeling in the legs, marked weakness on walking, with inability to work. These symptoms had lasted for over a year at the time when the patient was referred for study.

To enable a more thorough examination, particularly to rule out a spinal cord lesion, this patient was referred to Lakeside Hospital for study. He appeared a well developed, rugged farmer type whose complete examination was negative except for the weakness and altered sensation in the lower extremities. The disturbed sensation ranged from hypesthesia in the thighs to total anesthesia from the knees to the toes. The legs were weak and unsteady, the patient's gait ataxic. Yet the muscle size was average with no visible atrophy, the reflexes were normal, electrical tests showed average responses. There was some doubt on the part of the house staff who saw the patient as to the possibility of a serious disease of the spinal cord. Yet the character of the anesthesia, as well as the extreme weakness in the absence of atrophy, were strong arguments in favor of an hysterical paralysis.

During the few days in the hospital an attempt was made to learn more of the life history of R. F., his aims, his ambitions, his frustrations and disappointments, as well as his own ideas about his legs. He expressed the belief that the nerves in the legs had somehow become dead and that perhaps he might never walk well again.

It was decided that strong suggestion, accompanied by electricity, might influence the patient's mental attitude. I therefore applied Faradic stimuli at the peroneal nerve as it winds around the fibula. Stimulation of the nerve of course caused contraction of the muscles of the toes and an extension of the foot. The patient was amazed at seeing his hitherto paralyzed toes move. He was tremendously impressed by this "marvel." He was therefore told that this electricity would awaken the dormant nerves. After the first treatment there was a moderate improvement in power and anesthesia was gone. Within three days he walked perfectly well.

He has now returned to his farm, quite well recovered. However, he has written once that when he works hard his legs become numb.

Similar successes have been secured occasionally, only one more of which I shall recount. This is mentioned because of the age of the patient and because I was able to secure photographs which graphically represent the improvement.

CASE 6: E. C., aged 60, formerly a prosperous farmer, had lost his holdings and finally took up factory work. He was a night watchman at a plant. In the course of his employment he sustained a contusion of the left hand. The hand was dressed by the company physician who applied some medicine and a bandage. Lamp treatments were given. When the bandage was removed the patient's ring and middle fingers were flexed in the palm. He complained that he had loss of feeling in these fingers. The patient left the company doctor and consulted his own doctor. A diagnosis of traumatic neuritis involving the ulnar nerve

was made, and the patient was advised not to work. (See the pictures, which show the deformity of the hand.)

When I examined Mr. E. C. some two years after the initial injury, the left hand was held in a peculiar position with two fingers flexed in the palm. There was a corresponding loss of sensation over both the dorsum and the palmar aspects of these fingers. On first glance, this resembled an ulnar paralysis. However, a detailed neurological examination showed clearly the functional, hysterical nature of this paralysis.

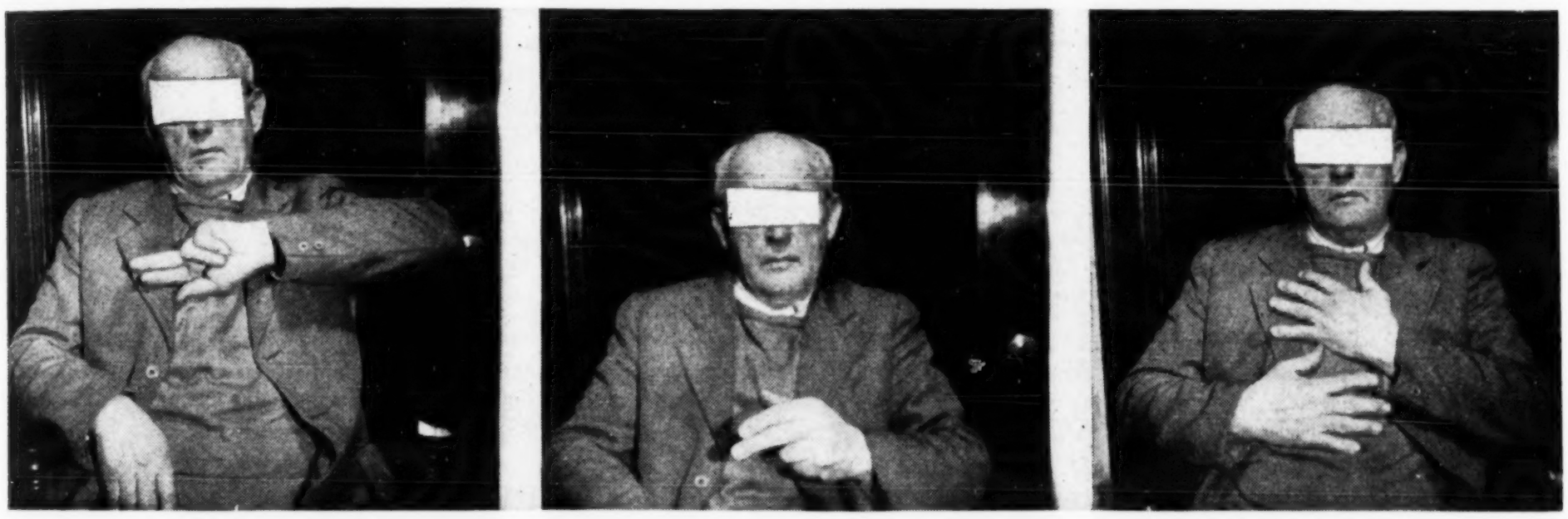
In this instance also effort was made to gain the patient's good will and confidence. I went far beyond his hand and into the story of his arduous climb to prosperity followed by speedy, precipitous descent into poverty, of his loss of faith in his family, of the difficulties of adjusting to a new necessary but disliked job. The examination likewise was time consuming and evoked considerable amazement and respect on the part of the patient. He seemed impressed by the many tests which are done in the course of the neurological study.

Often the treatment must be accomplished by explanation, reassurance, and education. At times, though successful, the symptoms may recur or other disorders appear in different parts of the body. Complete cure by medical means alone is not always possible and the circumstances surrounding the case may be important.

The following case history illustrates a "cure" achieved to some extent by psychotherapy, but largely through a work opportunity which presented itself.

CASE 7: J. K., aged 37, truck driver, referred by Dr. A. Miller, had suffered a contusion of the lumbosacral area which caused pain and stiffness in the back. The usual procedures of heat, massage, and strapping had no effect. Some weeks later a brace was applied with little or no improvement. A surgical procedure was contemplated, but the patient's tremors and fears caused the surgeon to delay.

When I was privileged to examine the patient a year had elapsed since the initial injury. It would take too long to review the many details of the personal and social history the patient gave me.



Illustrating an hysterical ulnar paralysis before and after treatment. First and second pictures: Palmar and dorsal aspects of left hand showing flexion contracture of left ring and middle fingers (hysterical ulnar paralysis). Third picture: Fingers extended—"Cure by Suggestion."

At this point suggestion therapy proved successful in a short space of time. I reassured the patient with utter confidence that he could be cured, and this statement was reinforced by the use of Faradic current applied over the ulnar nerve. The immobile fingers were made to extend and flex. After this the patient voluntarily extended his fingers and could use his hand quite well. (See Fig. 3.)

My few successes have been achieved, as a rule, through befriending the patient rather than ridiculing or insulting him. Treatment which is a compliment to the patient's ego is usually more successful than that type of treatment which assails or attacks it. In only one instance can I recall a "cure" by deriding or shaming a patient into recovery. Also it has not been necessary to give anesthetics to decide between functional and organic deformities. Above all, one should long hesitate before employing surgical measures in patients whose illnesses resemble organic disorders. Such individuals after operation rarely respond to psychotherapy. Indeed, two prominent orthopedic surgeons with whom I am associated have discontinued operative procedures on patients with chronic back ailments who have been receiving weekly disability payments.

Suffice it to say that there was a dominating fear of paralysis, due to what was interpreted as a spinal cord injury. The neurological examination was negative from the organic standpoint and a neurosis was diagnosed.

In this instance, as in the other case histories recorded, the patient was given a great deal of reassurance and a careful explanation was offered him.

In his case, because of a question in his mind of damage to the spinal nerve routes, a great deal of time was spent in "education." Mr. J. K. left my office feeling somewhat relieved but far from cured.

In the evening he telephoned to ask permission to go to work.

He explained that as he was passing his former place of employment his boss begged him to take a truck. There happened to be an emergency occasion to deliver a load to another city. This compliment to his driving ability, the financial reward involved, coming at the opportune moment when he had been reassured about fear of paralysis, helped him to regain his confidence. After some hesitancy I gave him permission to go to work. I believe he has been steadily employed for the past two years.

In this instance it is doubtful if psychotherapy would have been of any avail had not the work therapy appeared.

Symptomatic Therapy

COUPLED with any attempts to influence the patient's mental attitude must be those measures which are included in the concept, symptomatic treatment. This includes analgesics to relieve pain, sedatives to quell sensitiveness and irritability, occupational activity and recreational programs to divert the attention away from introspection. Local treatment, including massage, exercise, baths, and other forms of physiotherapy are valuable. This is not the place to go into details of the appropriate surgical and medical treatment which are necessary for the actual organic changes upon which a neurosis may be superimposed.

Medicolegal Considerations

NOT uncommonly a neurosis of trauma is complicated by medicolegal factors. These revolve about the question of compensation and often mean litigation. The matter of compensation is vitally connected with the success or failure in treatment. Indeed, the quest for compensation, whether it is refused or granted in one lump sum as a final settlement or whether weekly disability payments are given, is more significant than the medical attention in the final outcome of the illness.

Though a desire for indemnity is the chief motivating factor in Group III, yet the financial problems are significant in all types of neuroses, for such neuroses rarely occur unless some other individual is responsible for the injury.

The importance of the relation of compensation to the cure is such that it often behooves the medical man to concern himself with this phase of the patient's problem. Cure and routine compensation are often incompatible.

There have been several distinctly different attitudes on the part of doctors, courts and insurance companies and industrial commissions in regard to compensation. Some believe that neuroses, being illnesses, deserve full compensation; others are opposed to this view and have recommended that no money be paid for an illness so subjective and so intangible, for which the patient himself may be responsible (Reichardt[10]).

This is an involved question to which more attention should be given by a group of individuals, including physicians, attorneys, and sociologists. From a purely medical point of view, a law which would disallow compensation, seemingly a hardship, would be a blessing in disguise. I am sure that the neurotic would respond more quickly were he less interested in the money value of his illness. However, because the neurotic is ill and probably poor, needing medical guidance and believing himself ill, he would interpret the refusal of compensation as an individual indication of the world's unfairness. He might develop more symptoms to convince others of the validity of his illness or he would suspect the honesty of those who discontinued his compensation, particularly when the neurosis develops as an addition to an original organic injury and the transition of the one into the other is insidious. The patient would then never understand why he is not entitled to compensation.

The most practical solution represents a lump sum settlement which gives justice and victory to the individual, but which would imply finality. The amount allowed must depend upon the individual patient, the type to which he belongs, the time when the diagnosis was made, the organic associated disorder, and the needs of the patient. In civil cases the money award for such neuroses should be a small, nominal sum. For the industrial cases, the settlement should include a plan devised by a psychiatrist and a representative of the plant (social worker) or of the Industrial Commission to establish rehabilitation or new work adjustment. In Case 1 which I reported, the woman who had an hysterical scoliosis of the spine, the initial benefit from psychotherapy was reinforced by helping her to receive a lump settlement with which she planned to open a restaurant of her own.

This fulfillment of her aim was as much a factor in the cure as the suggestion.

Conclusion

THIS paper deals with the various aspects of treatment of the neuroses of trauma.

It mentions the need for prevention from both the safety, as well as the social, aspects. It indicates the value of early "preventive" treatment.

Actual treatment of the neuroses which have developed depends upon the group to which the patient belongs. It depends also upon the individual, his occupation, the nature of the trauma, and the possibility of compensation. All these factors require handling in the successful management of a patient suffering from a neurosis associated with trauma.

Certain procedures of psychotherapy are discussed.

Methods which gain the patient's confidence and faith (transference) and strong suggestions are recommended.

Several brief illustrative case histories are recounted.

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Association Meeting

THE Association for the Advancement of Industrial Medicine and Surgery will hold a meeting and an informal dinner on October 23, 1935, followed by a discussion on pre-employment examinations of employees.

Backache: Injury or Disease?

By RALPH E. SWARTS, M. D.
New York City

PAIN in the back, which the employee claims is due to an injury, frequently constitutes a problem that puzzles the industrial surgeon and seriously involves the finances of the insurance carrier. It is paradoxical economy for the employer to assume that the workman's backache will be of short duration and to instigate routine treatment at $2.50 for an examination, $1.25 for an office visit, $1.50 for daily physical therapy, the usual fees allowed under the California schedule, and up to $25.00 weekly compensation, merely because it appears cheap. The case frequently lasts indefinitely, and the total costs are staggering. The only way to prevent such waste is to have, before accepting the claim, a thorough diagnostic investigation, which is relatively expensive but in the final analysis is truly economical, since it prevents the insurance carrier from accepting the non-industrial case; and also humanitarian in that it prevents the employee from being subjected to a long course of improper and occasionally harmful therapy or damaging manipulations. A simple practical plan of differentiating between backaches due to injury and those due to disease should be welcomed, not only by physicians but also by employers, insurance companies and industrial boards. We are not concerned in this study with the workmen who have suffered legitimate injuries, for it is the function of the insurance carrier to assume liability for their care and to return them to work as soon as possible, not to try to escape liability on unjustified technicalities.

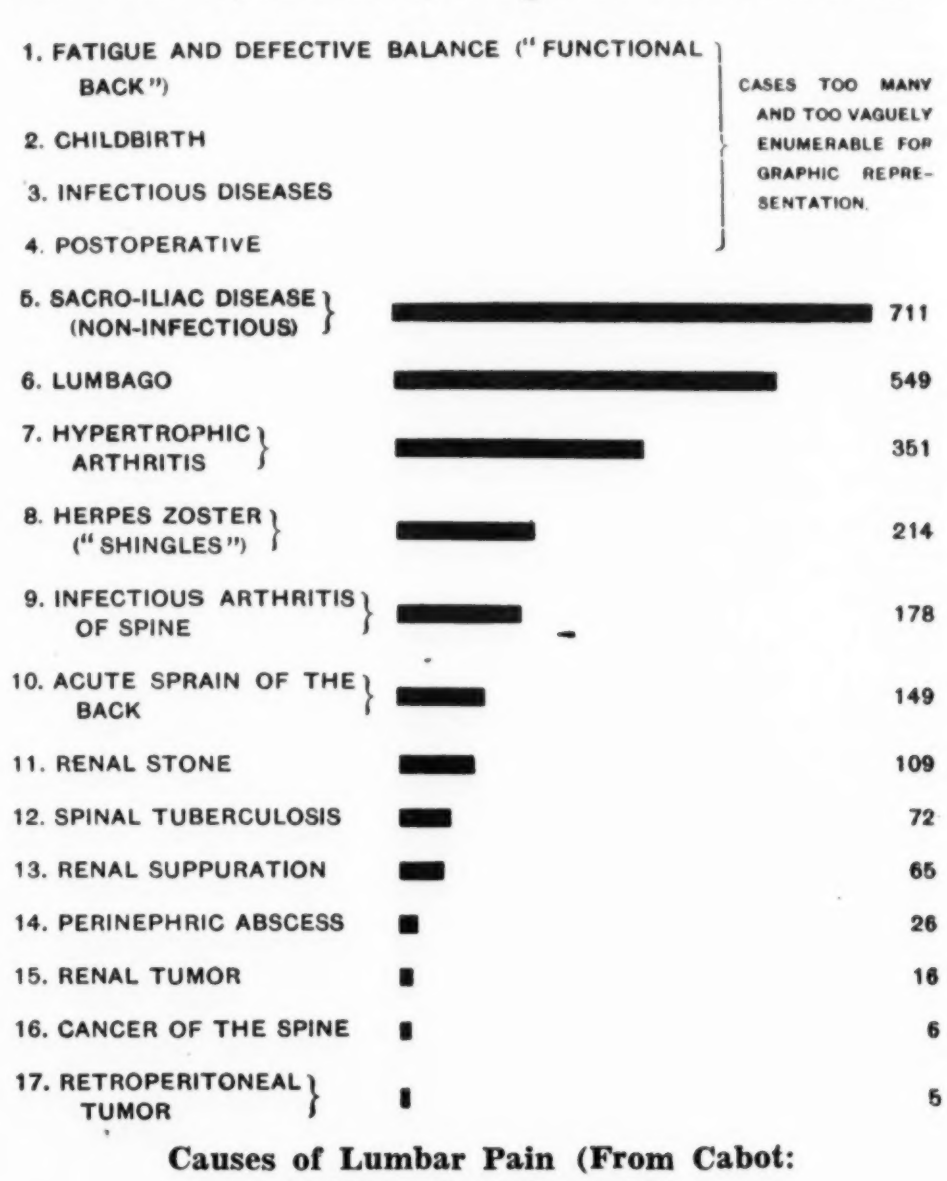
This paper is based on a study of the claims against an insurance carrier for back injuries under the provisions of the workmen's compensation acts. The cases considered represent all that were officially passed upon by the appropriate commissions, and in no case in the series of 30 cases was a final award made in favor of the employee. (Since preparing the manuscript six more cases have been decided by the commission and were all won by the insurance carrier.) Over 700 similar claims were denied by the same insurance carrier when it was found that the symptoms complained of were not caused or aggravated by injury, but were due to disease. None of this larger group of cases was litigated; they are therefore not presented here in detail.

In the old days of personal injury damage suits there was never a railroad employee involved in a train wreck who did not claim, among other injuries, that he had hurt his back. "Railroad spine" was a recognized term in medicolegal circles. Since the adoption of workmen's compensation legislation this diagnosis has become obsolete, but has been replaced by one equally illogical, "sacro-iliac slip" or "sprain of sacro-iliac joint."

Low back pain is not a characteristic symptom of any particular type of pathology, and as a rule the millionaire's lumbago and the workman's "sacro-iliac slip" are due to similar causes. No internist in private practice would consider treating a patient for subjective or objective symptoms without first determining their cause. The industrial case is entitled to the same careful examination as the private patient. We have demonstrated to our satisfaction that it is false economy to accept an industrial claim, no matter how trivial, without first arriving at a correct diagnosis and a determination of the underlying pathology; neither the employee nor the insurance carrier is thereby done an injustice. We have found that the report of the history, general physical examination and necessary laboratory investigations as rendered by the physician in general practice, are much more important than the report of most orthopedists, who, too often, either refuse to consider the medical facts or dismiss them altogether as unimportant.

Law—Injury

AN EMPLOYER is required by law to furnish medical treatment for *injuries* arising out of and in the course of employment in California, and in most states. Whether or not a disability is industrial is, therefore, a legal as well as a medical question. The term "personal injury" is snyonymous with accident, and legally is defined to be an unusual occurrence producing a quick result and coming from without. In two of our cases in which no medical testimony was introduced by the defendants, the commission ruled that there was no accident (Cases No. 26 and No. 29). Kessler[1] says, "When the trauma is direct to the back or sacro-iliac region, there can be little doubt as to the origin of the disability; but when the disability is attributed to an ordinary lifting effort, especially when the latter is a usual one, care must be taken before ascribing the subjective and even the objective findings to the alleged lifting effort. Too often the condition is not due to indi-


1. FATIGUE AND DEFECTIVE BALANCE ("FUNCTIONAL BACK")
2. CHILDBIRTH
3. INFECTIOUS DISEASES
4. POSTOPERATIVE
CASES TOO MANY AND TOO VAGUELY ENUMERABLE FOR GRAPHIC REPRESENTATION.
5. SACRO-ILIAC DISEASE (NON-INFECTIOUS) 711
6. LUMBAGO 549
7. HYPERTROPHIC ARTHRITIS 351
8. HERPES ZOSTER ("SHINGLES") 214
9. INFECTIOUS ARTHRITIS OF SPINE 178
10. ACUTE SPRAIN OF THE BACK 149
11. RENAL STONE 109
12. SPINAL TUBERCULOSIS 72
13. RENAL SUPPURATION 65
14. PERINEPHRIC ABSCESS 26
15. RENAL TUMOR 16
16. CANCER OF THE SPINE 6
17. RETROPERITONEAL TUMOR 5

Causes of Lumbar Pain (From Cabot: "Differential Diagnosis).

*Read before the Industrial Medicine and Surgery Section of the California Medical Association, at the 63rd Annual Session, Riverside, April 30, 1934.

1. KESSLER, HENRY H.: Accidental Injuries, Lea & Febiger, 1931, p. 26.

rect trauma but is incidental to a constitutional disorder, most frequently a toxic myositis from absorption from some focus of infection, a postural strain or some other pathology neither initiated nor aggravated by the alleged injury."

The physician who is called upon to diagnose or treat a claimant should first of all satisfy himself that there actually was an injury. This question can be answered only by obtaining an accurate record of the events preceding, concurrent with, and subsequent to, the onset of the painful symptoms. The employee's statement in his own words, given before his vocabulary has been contaminated by confusing medical terminology, is most valuable.

History

THE average doctor apparently believes that history taking was a menial part of the medical training required for his degree, and that, since he is in private practice, it is no longer necessary; consequently he accepts unchallenged the employee's statement that "I hurt my back." The physician should obtain a complete account of the alleged accident, and whenever the employee's history clearly shows that he was performing some usual type of work and that there was no unusual occurrence the physician should assume, until the contrary is demonstrated, that the case is one of disease and not injury.

Every physician who accepts industrial work should routinely obtain a clear concise history, complete in every necessary detail, and should have sufficient knowledge of the legal interpretation of the history to be able to decide whether or not the workman's story meets the requirements of an injury.

This history should include answers to the following questions: Did the employee slip or fall; did he suffer a direct blow or an unusual wrench; was an additional weight unexpectedly thrown upon him? If the answers are in the negative particular inquiry should be directed to determine if the employee was not doing his customary work in the usual manner, and if he had not repeatedly performed the identical duties in the same way previously without any untoward subsequent developments. If he was stooping, ask if the pain was first noticed on bending forward or on straightening the spine. If he was lifting, record the size, shape and approximate weight of the object lifted. Note down the directions and distance of the lift, the position of the trunk and extremities during the lift, etc. Inquiry should always be made concerning the exact time of the day when the employee noticed the first symptom, and especially to determine if there was an interval of time between the work incident and the onset of symptoms. Further important details include the exact time when the employee was obliged to discontinue work and the time when he notified the employer of his alleged injury. In our series, eight claimants quit work immediately at the time of onset of symptoms, 10 later in the same day, and 12 worked for varying longer periods of time before quitting. Immediate cessation of labor following a severe pain in the back is no more proof of an injury than is the acute pain that spontaneously develops when the same employee, sitting on the edge of the bed in the morning, stoops over to lace his shoe and is forced by the severity of the sudden onset of symptoms to lie back on the bed. Surely, no one would consider trauma as an etiological factor in such a case.

Because of the theory of "slipped vertebra" popularized by the cults, an employee who first notices a pain in his back while at work may honestly believe that he has received an injury. This is often apparent from the history which shows that the employee had consulted an irregular practitioner for a previous back pain and had been told, according to routine, that a vertebra was out of place, or had been so advised by some of his friends who had had similar experiences. The fear thus engendered, plus the promise of replacement of the offending vertebra by a series of treatments (cash in advance), plus an eagerly remembered coincident lifting effort while at work, together with the employee's inability to pay for the course of "adjustments" are often responsible for his belief that he is entitled to the benefits of the compensation laws.

Having obtained a clear history of the alleged accident, the examiner should forget for the moment that he is dealing with an industrial case and should proceed with the same routine history and examination as for a private patient. The general medical history with a detailed account of all past illnesses, both medical and surgical, is of paramount importance. Frequently, when this is completed the doctor has a very definite opinion as to the cause of the complaints, and the examination usually merely confirms this opinion. Often there is a history of a recent or existing attack of sore throat, coryza or cough, a story of devitalized or abscessed condition of the teeth, or a series of symptoms suggesting a lower genito-urinary infection. The fact that the employee denies all history of gonorrhoea means nothing. The laborer has been educated to believe that if he admits gonorrhoea it will prejudice his claim. As physicians, we know that gonorrhea is just as prevalent among the working class as among the employers of labor, i. e., private patients.

Whenever the examiner is not satisfied with the employee's version of what is alleged to have happened or suspects that the true account is being withheld or garbled, he should suggest an independent investigation at the scene of the alleged accident; if he has been unable to account for the symptoms by demonstrating their etiology and pathology, he should not hesitate to ask the employer or insurance carrier for examinations by specialists. Such requests should be freely granted. The shortsighted policy of paying indemnity and providing treatment for many months for an alleged injury which, by authorizing a complete medical examination, can be proved to be a disease, accounts for a large part of the steadily mounting costs of compensation insurance.

Examination

IN OUR experience no sign or group of signs can be relied on as being characteristic of any specific spinal pathology. The local changes commonly seen, such as stiffness, deformity, muscle spasm, pain or movement, referred pain, tender points, etc., are usually present in varying degrees. Any of the symptoms or any combination of them may result from different pathological causes. Some industrial physicians make a diagnosis of "sacro-iliac slip" by observing the gait and atti-

tude of an employee as he enters the office. This is not only expensive to the insurance carrier, but also dangerous to the physician's reputation. In case No. 23 the physician was so sure of his diagnosis of "severe sacro-iliac sprain" that he did not consider it necessary to order a roentgen study, but proceeded to manipulate the back. He was surprised to learn later that instead of sacro-iliac sprain the man had a carcinoma involving the lumbar spine, pelvis, and neck of the right femur, and the snapping noise heard at the time of manipulation was undoubtedly due to the fracturing of the femur.[2]

A complete physical examination, to include laboratory tests, whenever indicated, and roentgen studies, is always required. The search for evidence of acute or chronic infection should be as extensive as necessary to demonstrate definite findings.

The body temperature very often indicates some degree of active infection. All suspicious teeth should not only be x-rayed but also tested for vitality, as negative dental films are not conclusive of the absence of periapical infection.[3] The tonsils occasionally, and the paranasal sinuses less frequently, are the harborers of infection responsible for pain in the back. In our experience the lower genito-urinary tract is the commonest nidus of infection to be overlooked by the average physician.[4] In addition to inspection and palpation of the external genitalia, the prostate and seminal vesicles should be investigated by digital exploration per rectum. The expressed secretion should be examined microscopically, preferably with an unstained specimen. The presence of pus indicates infection, and we are not concerned as to the causative organism. It may have originally been the gonococcus which has been replaced by a pyogenic invader, or the primary organism may have been non-specific, consequently a stained smear reported "no gonococci" is meaningless. If secretion cannot be expressed by the first massage it should be repeated at subsequent visits, especially if the prostate is tender. Sometimes several vigorous massages on different days are necessary to open up plugged ducts sufficiently to allow the pus to be expressed. The fact that there is pus in the prostate does not always mean that it is responsible for the symptoms. It is the dammed up undrained focus of infection in which we are interested.

Furthermore, unless the examiner has a long finger he will very probably be unable to strip the seminal vesicles. We have seen cases in which the seminal vesicle contents consisted of 100% pus and yet previously the expressed prostatic secretion had been reported by the short-fingered examiner to contain no pus. In several of our cases the back pains have entirely disappeared within 24 hours following the emptying of the vesicles for diagnosis. In this series the presence of lower genito-urinary infections was established in over one third of the cases. Bartholin's, Skene's glands and the cervix in the female should be carefully examined for evidence of acute or chronic infection.

2. WESSON, MILEY B.: Carcinoma of the Prostate, Unusual Metastases. *Am. J. Surg.* 12, Case 1, 537-542 (June) 1931.
3. RHOADS, P. S. and DECK, G. F.: Roentgenographically Negative Pulpless Teeth as Foci of Infection; Results of Quantitative Studies. *J. A. Dent A.* 19: 1884, 1932.
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Diagnosis

WE FOUND in this series of 30 cases that the back pains in those who had a short period of disability were generally due to myofascitis,[5] while those of longer periods of disability were commonly caused by spinal arthritis. Of the more severe disabilities, carcinoma, tuberculosis, syphilis, osteochondritis and subacute bacterial endocarditis were the primary cause.

In our series of over 700 unlitigated claims not presented here we have established among others, the following diagnoses: Paget's disease, pregnancy, congenital dislocation of hip, uterine fibroids, spondylolisthesis, acute rheumatic fever, pituitary disease, coccygodynia, multiple sclerosis, congenital cystic disease of kidneys and liver, kidney stone, gangrenous appendicitis and epidemic sore throat.

Some type of sacro-iliac injury was the erroneous diagnosis made by the physicians originally examining 15 of the 30 tabulated cases. The real cause of the symptoms in these 15 cases, however, was in eight arthritis, five of which were complicated by "sciatica"; one infectious osteitis and myofascitis; one metastatic carcinoma; one syphilis; one aortic aneurysm; one nephroptosis; and in two cases the cause was not determined except that in one (No. 25) all evidence indicated malingering. Of the 16 arthritics in the series, genito-urinary infection occurred in seven, infected teeth in six, infected tonsils in five, and in four cases there was more than one infectious focus. If only to avoid subsequent embarrassment, the examiner should employ all of his diagnostic acumen.

The fallacy of the sacro-iliac theory is well exemplified by case No. 15. This employee's symptoms were all referred to the *right* lower extremity and to the lower back. He claimed, however, that his *left* hip had been thrown against the left side of an upholstered automobile seat. The first examiner, not an M. D., made a diagnosis of "right sacro-iliac subluxation," manipulated the back and applied a sacro-iliac belt. Later on, suffering from a relapse, the employee consulted two prominent orthopedic surgeons, both members of the teaching staff of one of the San Francisco medical schools. The first orthopedist made a diagnosis of "right sacro-iliac strain," and the second "right sacro-iliac slip." Employing the same technique as already used by the first examiner, these two orthopedists proceeded to manipulate the back under an anaesthetic and reported the usual "clicking" in the right sacro-iliac during the manipulation. Both orthopedists knew of the previous history of rheumatism and of the presence of definite focal infection in the tonsils, prostate and seminal vesicles, but apparently these facts meant no more to them than to the first examiner, since neither considered them as of any importance in his diagnosis or treatment of the complaints. On their reports the case was carried to the higher courts, which upheld the commission. The employee's disability continued until he had appropriate treatment for his prostatitis and seminal vesiculitis. After six weeks he reported that he was entirely well and has remained free from all symptoms.

Sacro-iliac strain is a loose term applied by many surgeons to any painful back condition; it

5. ALBEE, FRED H.: Myofascitis from an Orthopedic Standpoint. *J.A.M.A.* 91, 1364, (Nov.) 1928; Myofascitis. *Am. J. Surg.* 23, 70-78 (Jan.) 1934.

Case	Age and Sex	Occupation and Nationality	History	Diagnosis Made by Physician First Consulted	Final Diagnosis	Associated Conditions	Decisions of the Industrial Accident Commissions
1. C.S.L. (Cal.)	55 M	Auto Mechanic American	Leaning forward unscrewing storage battery terminal bolts when felt a sharp pain in lower back. Quit work two weeks later.	"Sprain of back."	Hypertrophic arthritis of dorsal and lumbar spine.	Past history of rheumatism. Old injury to 3rd lumbar vertebra.	Injury not established. Disability not caused by employment.
2. J.P. (Cal.)	49 M	Janitor Italian	Started to lift a three gallon bucket half filled with water and got a "catch" in back. Quit work three days later.	"Sprained back."	Arthritis of lumbar spine and sacro-iliac joints. Sciatica.	Prostatitis, seminal vesiculitis secondary to gonorrhoeal urethritis.	Injury not established. Disability not caused by injury arising out of employment.
3. J.W.D. (Cal.)	53 M	Ranch Hand American	Swinging a box of oranges from ground onto wagon when he felt a "catch" in lower back. Quit work immediately.	"Sacro-iliac sprain."	Arthritis of lumbar spine and right sacro-iliac joint. Sciatic neuritis.	Prostatitis. Oral sepsis.	Disability arising out of employment not established.
4. P.S. (Cal.)	58 M	Fruit Picker Spanish	Reached up to pick some cherries and felt a pain in the lower left back and left groin. Quit work a half hour later.	"Badly sprained sacro-iliac joint."	Arthritis of lumbar spine and sacro-iliac joints.	Oral sepsis.	The arthritis was not caused or aggravated by injury or strain arising out of employment.
5. E.M.L (Cal.)	44 M	Truck Driver American	While lifting milk cans weighing 100 lbs. (had been doing same work for five years), began to have pains in back. Quit work three days later.	"Severe sacro-iliac strain."	Lumbo-sacral arthritis.	Badly infected tonsils.	Not established that condition complained of arose out of and in the course of employment.
6. C.B. (Cal.)	46 M	Stove Mechanic American	While holding onto a stove helping another lower it from a truck felt drawing sensation in cords of neck, later extending into back. Quit work after one hour. Two weeks later awoke with pain in lower back extending down left leg.	"Severe sprain of muscles of neck and back."	Extensive arthritis of entire spine.	Oral sepsis.	The spinal arthritis was not caused or exacerbated by an injury arising out of and in the course of the employment.
7. M.B. (Cal.)	46 M	Laborer Italian	Prying up end of a pole onto truck when felt a stinging pain in right hip near the back. Quit work four hours later.	"Sprain right dorsal region of back. Sacro-iliac strain."	Chronic spinal arthritis.	Chronic prostatitis and and seminal vesiculitis.	The painful symptoms in the lower back were not caused by industrial injury but were due to a diseased condition.
8. F.C.S. (Cal.)	41 M	Chemist American	While lifting manhole cover off gasoline tank left foot slipped and felt a sharp pain in lower back which decreased during day. Quit work eight weeks later.	"Sacro-iliac sprain, sciatica."	Chronic sacro-iliac and lumbar spinal arthritis. Sciatic neuritis.	Prostatitis secondary to gonorrhoeal urethritis and epididymitis. Diseased tonsils.	Evidence does not establish that disability was caused, aggravated or accelerated by injury as claimed.
9. T.C. (Cal.)	54 M	Salesman Italian	Lifted a sack of potatoes into his arms and turned to put it down on a handtruck when he felt a pain between shoulders. Quit work immediately.	"Traumatic myositis."	Arthritis of dorsal and lumbar spine. Myositis of neck muscles.	Past history of lumbago. Obesity. Acute coryza. Oral sepsis. Tonsilitis.	An injury arising out of employment not established.
10. G.H. (Wash.) (Longshoremen's and Harbor Workers Compensation Act, Federal)	53 M	Longshoreman Scandinavian	Lifting one end of a long plank with three other men. Felt sharp pain in the small of his back. Let go of the plank and couldn't straighten up. Quit work immediately.	"Severe sprain and tearing of intraspinous ligaments."	Extensive arthritis of dorsal and lumbar spine.	"Compensation" or "desire neurosis" (aphilopony) subsequent to prolonged litigation.	Award by the deputy commissioner in favor of the employee set aside by the courts, "the evidence being scanty, ambiguous, indefinite and uncertain in respect to the elements of effect, continuity and time."
11. A.W. (Ariz.)	35 M	Laborer American	Moving wagons by hand at cotton gin. No symptoms at the time. In evening hip began to pain and next morning was stiff. Quit work 12 days later.	"Sciatic rheumatism." "Strained hip."	Arthritis of lumbar spine.	Past history of lumbago. Oral sepsis.	Disability not the result of an injury. An injury arising out of employment not established.
12. M.H. (Cal.)	30 M	Concrete Mixer American	Fell face downward in soft dirt. Felt a slight catch in right lower back but continued working. Two days later while loading concrete blocks onto a truck hip began to hurt. Worked two days before quitting.	"Infectious arthritis 1st and 2d lumbar vertebrae."	Subacute bacterial endocarditis. Arthritis of right sacro-iliac joint.	History of rheumatic fever, age 16. Chronic tonsilitis.	The streptococcus viridans septicemia was not caused by an injury arising out of and occurring in the course of employment.
13. L.K. (Cal.)	49 M	Laborer American	Standing in front of an automobile pushing it on a level floor. Four hours later quit work when he began to suffer from pain in left leg.	"Lumbar arthritis. Sciatica."	Lumbar arthritis. Sciatica.	Oral sepsis. Purulent. Prostatitis. Chronic pyelonephritis. Urethral stricture.	Injury arising out of and in the course of employment not established.

is a term used to describe a varied symptom complex, and is therefore of no scientific significance. Personally, we have not been able to subscribe to the commonly recognized concept of sacro-iliac injury unless the articulation has suffered real trauma of a substantial character. Even with severe trauma, and we include those cases of fracture with displacement and subluxation of the fragments causing a permanently disrupted joint, we have not observed the symptoms which are supposed to be characteristic of injury to the sacro-iliac. This synchondrosis is one of the most stable "joints" in the human body, and mechanically we have never been able to understand how it can be so easily subluxated as those who support this theory would have us believe. Experiments in the anatomical dissecting laboratory have shown that it is impossible with mallet and chisel to separate the sacrum from the ilium, even when all the muscles have been stripped off, without breaking the bones. Assuming that the joint actually does become subluxated as claimed by the supporters of this theory, it is impossible to conceive of how this subluxation could be responsible for the wide variety of symptoms complained of, seen in cases diagnosed sacro-iliac strain, sprain, slip, subluxation, etc. If the assumption that a lax or subluxated sacro-iliac joint is responsible for disabling symptoms is correct, then a fixation of the joint by surgery should result in complete relief. We have neither seen nor have we heard of a cure by such a method; on the other hand, however, the insurance carriers which have authorized such operations have reported uniformly unfavorable results. The industrial commissions are not recommending fixation operations for so-called sacro-iliac injuries because they know that the results are always disappointing, and even some of the orthopedists are admitting it and are going back to plaster spicas, rest and physical therapy.[6]

Painful backs are so common in those not subjected to injury that it is not surprising, therefore, that the commissioners of the industrial commissions have taken judicial cognizance of this fact and have made their decisions accordingly. The doctor who lets himself be influenced by sympathy for the workman and who fails to exercise a critical attitude in his examination is apt to be chagrined to discover that his reports have been ignored by the referee who, by reason of his legal training, cannot reconcile the physician's opinion with the facts of the case.

Attitude of the Physician

WHEN the examining physician has discovered that there was no injury and that there is sufficient disease present to account for the symptoms, his work is only half finished. He should then tactfully explain the situation to the employee and advise him to consult his family physician for whatever treatment is indicated, since the insurance carrier is not responsible for furnishing treatment or for paying indemnity for time lost. If, on the other hand, the history and examination indicate that there was an industrial injury, appropriate treatment should be instituted even though the injury may be complicated by disease. The occasional borderline case should be referred to the insurance carrier's medical department for further disposition.

Summary

OVER 700 employees claiming injury to the back were found to be suffering from disease adequate to account for all of their symptoms, and in the absence of a history of an injury were denied medical treatment and indemnity. Thirty of these employees, not being satisfied with the denial of their claims, appealed to the industrial accident commission. In none of these cases was a final award made in favor of the employee.

2. Only two of these 30 litigants were originally seen by physicians following this medicolegal plan of differential diagnosis, otherwise there undoubtedly would not have been so many cases referred to the commission.

3. By the adoption of such a plan employees have benefited by being spared the harmful effects of having to submit to treatment for an injury whereas they actually required treatment for disease. Employers and insurance carriers have benefited by not having saddled onto them the burden of taking care of non-occupational disease. Physicians have benefited by being able to differentiate the medical from the industrial backaches, and immediately to inaugurate proper treatment for the workman who has a genuine injury.

4. By divorcing any attribute of injury from these claims at their onset through the application of sound scientific principles, much unnecessary litigation has been eliminated, thereby reducing the expense to the state of administering the workmen's compensation laws. The purpose of these laws to rehabilitate injured workmen miscarries when indemnity and useless orthopedic and physical therapy treatments are furnished a claimant for many months for an asserted sacro-iliac sprain which in reality is an infectious arthritis secondary to infected teeth, tonsils, gallbladder or prostate. Several such cases have been closed out in desperation by the California commission which months later was confronted with the problem still unsolved, since there was a return of all the old symptoms—the focal infections not having been influenced by judicial decrees.

5. Sacro-iliac strain, sprain, slip or subluxation are terms which should be relegated to the discard, as they belong in the same category as the long obsolete "railroad spine." No pathologist, anatomist or roentgenologist has ever positively demonstrated a sacro-iliac slip. Consequently when this diagnosis is made by industrial surgeons, it indicates a symptoms complex and not a clinical entity. Sacro-iliac slip is a misnomer, and together with its synonyms should be completely expurgated from our medical nomenclature.

Discussion

DR. HARRY J. SCHOTT, Los Angeles: Dr. Swarts' discussion of "Backache—Injury or Disease," based on experience from a large number of industrial cases, is very timely. It presents a subject of utmost importance to industry, insurance carriers, and those of the medical profession who are engaged, even remotely, in industrial practice.

The importance of a correct and early diagnosis of alleged industrial injury, whether confined to the low back or other parts, cannot be too strongly emphasized. I am glad he spoke of the importance of a careful history. Much valuable information can in most cases be secured by spending sufficient time in this manner. Most

6. PAINTER, CHAS. F.: The Origin and Spread of the Sacro-iliac Idea and its Menace. *Boston M. & S. J.* 194,613, (Apr.) 1926.

Case	Age and Sex	Occupation and Nationality	History	Diagnosis Made by Physician First Consulted	Final Diagnosis	Associated Conditions	Decisions of the Industrial Accident Commissions
14. L.A.R. (Cal.)	36 M	Sack Sewer American	Was sewing and jigging (shaking down contents of) sacks of grain when he felt a catch in his back. Quit work immediately.	"Sacro-iliac strain."	Lumbar hypertrophic arthritis.	Old injury to left hip.	Injury arising out of employment not established. Disability not caused by an injury.
15. C.B.C. (Cal.)	32 M	Produce Salesman and Buyer Spanish-American	Left hip thrown against side of seat in minor auto accident. Onset of pain in calf of right leg 45 minutes later, of pain in right buttock eight hours later. Quit work three weeks later.	"Right sacro-iliac slip."	Right sacro-iliac arthritis, "Sciatica."	History of a previous attack of rheumatism. Infected tonsils, urethral strictures, prostatitis, seminal vesiculitis.	Applicant did not sustain an injury. Disability not due to an injury arising out of and in the course of employment.
16. R.V.L. (Cal.)	36 M	Truck Driver American	Was swinging a box of tomatoes up onto a stack and felt something "give away" in left lower back. Quit work after driving truck 10 miles to warehouse.	"Sprain back."	Infectious process in intervertebral space between 4th and 5th lumbar. (Osteomyelitis or tuberculosis.)	Aggravation of infection by chiropractic manipulations.	The infectious process in the lumbar spine was not caused or aggravated by injury arising out of his employment.
17. A.T. (Cal.)	38 M	Laborer Italian	With other men was lifting marble foundation when felt pain in lower back. Quit work at end of day. Developed urethral discharge later in the same day.	"Severe strain of sacro-iliac joint."	Gonorrhoeal arthritis and prostatitis.	Gonorrhoeal urethritis and prostatitis.	There was no injury arising out of employment. Disability not due to an industrial injury.
18. J.W.R. (Cal.)	31 M	Truck Driver American	Loading barrel of compound onto truck, felt a pain in back. Quit work two days later.	"Myofasciitis."	Myofascitis.	History of previous similar complaints Oral sepsis. Gastric ulcer. Spinal anomaly. Chiropractic manipulation.	Not established that disability arose out of and in the course of employment.
19. J.D. (Cal.)	31 M	Ranch Hand Slav.	Stooped over and started to lift up a box of prunes and felt a sudden sharp pain in lower back. Quit work immediately.	"Lumbar myalgia."	Myofascitis.	Prostatitis and seminal vesiculitis.	Employee was under no unusual strain and received no injury. The back symptoms were caused by disease
20. T.O.B. (Cal.)	38 M	Laborer American	While prying on a boulder with a pick felt something "give away" in the middle of his back. Quit work immediately.	"Back strain, lower dorsal lumbar and ilio-costal. Myalgia."	Radiculitis. Myositis. Osteochondritis.	Chronic purulent prostatitis and seminal vesiculitis.	Condition complained of not caused or exacerbated by industrial injury; not entitled to medical treatment or compensation.
21. F.D. (Cal.)	43 M	Cook American	Put a pot of soup down on the floor, couldn't straighten up on account of pain in back. Quit work three hours later.	"Lumbar myositis."	Lumbar myositis.	Oral sepsis.	Evidence insufficient to establish that the disability was caused by an injury arising out of employment.
22. E.S. (Cal.)	27 F	Clerk. American	Lifted a pan of pastry down from a rack and twisted a little to one side. On straightening around felt a sharp pain in small of back. Quit work two weeks later.	"Sacro-iliac strain."	Infectious process in body of 2nd lumbar vertebra. Myofascitis.	Chronic tonsilitis. Pharyngitis. Chronic sinusitis. Congenital spondylolisthesis of slight degree.	Condition complained of was caused by infection and not by injury arising out of and in the course of employment.
23. L.B. (Cal.)	56 M	Laborer Italian	Shaking a barrel of brussels sprouts to pack them down tightly and felt a pain across lower back. Quit work 30 minutes later.	"Severe injury to lower lumbar and sacro-iliac region."	Carcinoma of prostrate with metastases to pelvis, lumbar spine and neck of right femur.	Pathological fracture of neck of right femur due to manipulation for "sacro-iliac slip."	Decision postponed without date due to failure of employee to prosecute claim.
24. W.F. (Cal.)	41 M	Nursery-man American	Pushing a wheelbarrow over an uneven surface and felt a pain in back below ribs. Quit work two days later.	"Old spinal tuberculosis with hunchback deformity	Old hunchback deformity lower dorsal spine from tuberculosis in childhood.	Recent spinal fusion operation. Gonorrhoeal urethritis.	Injury arising out of and in the course of employment not established. Disability not caused or aggravated by industrial injury.
25. J.B. (Cal.)	40 M	Laborer Mexican	Coming down a ladder empty handed when he felt a pain in the middle of his back. Had been carrying tile and plaster up the ladder previously. Quit work after 45 minutes.	"Sacro-iliac strain."	Not determined.	Malingering.	Injury not established. Disability not the result of trauma.
26. A.C. (Cal.)	49 F	House-keeper American	Had been standing on a ladder hanging curtains. Later, while standing still, doing nothing felt a severe pain in lower back. Quit work three days later.	"Sacro-iliac strain."	Not determined.	Not determined.	Evidence fails to establish that the strain complained of was caused or exacerbated by an industrial injury

Case	Age and Sex	Occupation and Nationality	History	Diagnosis Made by Physician First Consulted	Final Diagnosis	Associated Conditions	Decisions of the Industrial Accident Commissions
27. F.C. (Cal.)	63 M	Paint Mixer American	Helping two others lift a stamp machine. Felt a sharp pain in lower back. Quit work immediately.	"Left sacro-iliac slip."	Aneurysm of abdominal aorta with erosion of 11th and 12th dorsal and lumbar vertebrae.	Syphilis.	The ruptured aneurysm was not caused or aggravated by strain arising out of an in the course of employment.
28. F.P. (Ariz.)	58 M	Kitchen Helper Italian	Lifting a case weighing 150 lbs. No symptoms. Worked five hours and sat down to rest, few minutes later got up and felt a severe pain in his lower back. Quit work seven weeks later.	"Sacro-iliac sprain."	Syphilis.	Oral sepsis. Prostatitis. Blood Wassermann 4 plus.	Industrial Commission refused to recognize claim on receipt of physician's report. No hearing held.
29. L.F.P. (Cal.)	59 M	Carpenter American	Handling heavy timber while standing in water up to knees when he felt sudden pain in lower back. Quit work at end of day.	None and by physician Chiropractor or reported "slipped vertebrae."	Not verified.	Past history of rheumatism and of pain in the back; frequent colds.	The slipping vertebrae complained of was neither caused or exacerbated by industrial injury.
30. E.K. (Cal.)	53 F	Janitress American	Was bending over a desk raising a window which gave way and her right lower abdomen was pressed against the desk. Quit work immediately.	"Right sacro-iliac slip. Strain of the lumbar muscles."	Marked right nephroptosis.	Chronic pulmonary tuberculosis. Cystocele. Rectocele.	Not established that applicant's disability is the result of injury arising out of and in the course of employment or injury at all.

patients, and especially one who is malingering, will make the diagnosis for you, if you will only permit him to tell his story. He may be reticent at the outset, but before long he almost invariably divulges pertinent information.

Aside from a careful physical examination, and advisable laboratory work, I consider the use of the x-ray as absolutely necessary. This examination in my opinion should be made by one specializing in roentgenology. His technique is usually better, and his opinion adds weight to the diagnosis if presented before the industrial accident commission. The examination should cover sufficient territory. Many pathological conditions cannot be determined accurately without it. The extent and duration of the pathological process can thus be definitely determined at the time of injury, and the question of its relationship to the alleged trauma can be definitely answered.

My own practice, and I am certain also the practice of other orthopedic surgeons, will bear out Dr. Swarts' statement relative to the frequency of arthritis and other pathological conditions in connection with alleged low back injuries, and the economic importance of determining whether such case shall be accepted as an industrial injury.

The law on this point, if understood, should eliminate many cases of low back pain caused by disease. In order to be classed as an industrial injury the act causing the disability must be of "unusual force," and not the ordinary motions or actions usually exerted by the individual in the routine performance of his regular duties. If this point were clearly understood by the doctor who originally sees the applicant, a great deal of future misunderstanding would be eliminated at the outset. Once a case is accepted as industrial, it becomes a problem of major importance when compensability is later questioned.

Just a word regarding sacro-iliac slips: Dr. Swarts has made it perfectly clear that he has never seen one. I have yet to see my first case of sacro-iliac slip, and I have never seen a doctor who claims to have seen them who is able to demonstrate one when he attempts it.

DR. GEORGE J. McCHESNEY, San Francisco: I am sure you will all heartily join with me in feeling that Dr. Swarts' paper is a most timely and useful analysis from an industrial standpoint of that most interesting and oft discussed subject, the "sacro-iliac slip." In the earlier days of our local orthopedic club, no matter what the regular program might be, sooner or later, we would be arguing about the sacro-iliac joint, until finally we agreed to disagree. This difference of opinion has persisted till the present, but not so much among orthopedists, who have pretty generally, but not all, given up the "slip" idea, but rather among general surgeons and medical men who still cling to the theory that a "slip" of the joint is causing the symptoms of pain, often excruciating, with or without sciatic involvement. Personally I have always felt that "sacro-iliac slip is a misnomer and should be expurgated from our medical nomenclature," as stated in the concluding words of Dr. Swarts' paper.

What is it then that causes a sudden, severe pain in the lower part of the back when it is put upon more or less sudden and severe strain or stress, sometimes even accompanied by a "tearing or snapping" sensation? In seeking an answer to this question, I would refer you to the work of Burbank, of New York who* attributes all chronic non-specific arthritis to hematogenous streptococcal infection. It is also proved that the streptococcus, although borne by the blood, flourishes in tissues with poor blood supply, such as ligaments, capsules of joints, tendons, fascias and connective tissues generally.

We have then the factors necessary for the typical "slip" symptoms; namely, a gradual accumulation, often over many years (for the typical "slip" does not occur in young people even though their joints are more supple and relaxed) of nests of streptococci or their toxins, in the region of the largest ligaments in the body and the greatest amount of connective tissue. When these toxin-overloaded tissues getting ready to explode, so to speak, are subjected to a strain or pull, they react to the extra irritation and the result is an acute muscle spasm or cramp, often of a highly painful degree of intensity. The severity of the strain on the tissues is not a measure of the severity of the reaction. I have seen severe sacro-iliac symptoms follow the simple act of bending over a wash basin. The snapping or tearing sensation in moderate or severe injuries can be accounted for by rupture of a few ligamentous strands, but not enough to change the shape of the joint any more than is caused by similar pathology and symptoms at knee or shoulder.

It must be borne in mind that sacro-iliac joint, contrary to Goldthwait and his school of thought, is one of the most stable joints in the body, as Dr. Swarts has stated. Fractures, as you know, almost never involve the joint, and dislocations or true slips, showing in the x-ray, occur about as often. We do not realize enough that the two articular surfaces are fastened directly together by a large mass of short transverse ligamentous fibres as well as the periarticular ligaments, all conferring a high degree of stability but making a fertile soil for streptococcal growth. This region of large amounts of ligamentous and connective tissues, especially in short stocky workingmen, shows its susceptibility to arthritis, in the after symptoms of fractures of the 12th dorsal or 1st or 2nd lumbar vertebrae when, after the usual immobilization period, the man complains more of the sacro-iliac re-

*In *J.A.M.A.*, October 29, 1932.

gion than he does of the fracture region. You have all seen this many times.

In short, let us constantly think of the sacro-iliac area as one peculiarly prone to chronic arthritis, especially in working men past 35, and when an industrial injury is proved by applying the rules in Dr. Swarts' paper, let us primarily consider the hitherto latent arthritis as affected by the injury, and treat it by attention to focal infections, heat therapy, manipulations occasionally, and fusion operations not at all.

Hi, Gene!

One Industrial M. D. to Another

HI, GENE! I hear you've started in industrial medicine. Well, a young man can do that nowadays with what you might call the utmost propriety. But time was when he couldn't. And, as medical history is reckoned, not so very long ago, either. I remember when I became a 'company doctor'. Certain of my professional brethren thought I'd mortgaged my intellectual (such as it was) integrity. And for a while after I got into the work I guess I nearly agreed with them. My decision was made rather suddenly. We've had other depressions; the economic impasse, you know, isn't a discovery of your generation. I was facing one myself, and as I look back upon the way I solved it the old story comes to my mind of the two (of course they were Irishmen) who went hunting with one gun. Pat shot at a bird, and missed. He handed the gun to Mike to load. But instead of loading Mike took aim.

"Don't shoot," said Pat, "the gun ain't loaded."

"I gotta shoot," said Mike, "the bird won't wait."

So, way back in the days '*B*efore *C*ompensation', I went on a company payroll.

THOSE, my dear Gene, were the great days. Thirty years hence it won't be nearly so interesting to look back upon the industrial medicine and surgery of the present time as it is now to look back upon industrial medicine and surgery as it was then. Not that reminiscence at such a future date won't have its points — the 'elder statesman' of that coming period will have many developments to recall with pride. And there will be much progress to review with satisfaction. Three decades from now the pre-employment physical examination will, no doubt, be as much a requisite of going to work as compensation is now a perquisite of being at work. Preventive measures as to occupational hazards of all kinds will probably have become as really preventive in respect of the working public as public health measures now are in respect of the general public Safety engineering may have been so perfected that all industrial accidents—instead of 90% of them—will be the fault of the human element. And that element, indeed, may have become educated to the point, at least, of the nearer-elimination of accidents—though I have my doubts.

But even if all this should come about, it will have occurred, as to time, '*A*nnis *D*octoris'. And hardly a man will be then alive to remember—as so many who lived through them can now remember—the trail-blazing, pioneering, catch-as-catch-can days when there were only a few of us who were courageous enough, or, as it seemed at the time, foolish enough, to enter the new territory of the employment relation. Each one who began then was on his own. We were not many, and we were far apart. But industry was growing, and so was the spread of workmen's compensation coverage. And each year saw more men getting interested.

In pre-medical days I earned college money as instrument-man on railroad surveys. (They were still building railroads; Henry Ford was still a mechanic.) And now when I look back on the history of industrial medicine and surgery, I like to 'survey' the field, like to think of it in engineering terms. I see the times '*B.C.*' as those in which beginnings were made, principles were recognized, and origins were born. Then, as the era responded to mechanization, industries slowly became conscious that 'The Years of the Doctors' were upon them, and that the works of the doctors, as they had been doing them here and there, were gradually assembling themselves upon a periphery and becoming directed, each on a radius of its own, toward the center of the teeming scientific circle that is the industrial medicine and surgery of the present time.

There were more of these beginnings, principles and origins than it was possible to realize from their midst. But we can see them now. The penumbra of the transition period has fallen away from them one by one, and they have been successively revealed as full sectors of the industrial medical circle, overlapping and combining at their radial boundaries, but each identified with its medical pioneer, each upraised with the third dimension of his work upon it. Today, from the central hub of retrospective outlook, a theodolite eye can sweep the field full round. And from now on, a survey in any sector must orient its minutiae of measurements to the clearly-marked lines, and gauge its elevation from the carefully-laid levels, established by the pioneers. For their mile-posts square the circle, and their benches map the contours, of medicine and surgery in industry as completely as township meridians and heights-above-sea-level define the situation of industry itself.

But could I have traversed the periphery while it was still in the shadow of the beginning days! Could I have come upon the individual at work in his sector while yet the work itself was his only interest and he hadn't become aware of the arc which, at circumference, would close him into the area of a future distinction, nor the angle which, at center, would connect his work with that of the others who, likewise, in other sectors, were shaping the field!

THERE was Fulton, making the first physical examinations among industrial employees, Apfelbach, digging out fundamental relationships with reference to carbon monoxide poisoning, Bowen, investigating industrial affections of the skin. Cheney was preparing to carry over into industrial medicine the best in internal medicine. Irving Clark was finding, in the organization of medical service in industry, professional manifestation of an outstanding executive genius. Crowder was making a science of sanitation. Drinker, who was to become later the country's leading, was then becoming the country's first industrial physiologist. Edsall was applying himself to manganese poisoning. Erdman was studying caisson disease. Gardner was directing his talents to the pathology of silicosis and its relationship to tuberculosis. Albert Gray was getting himself ready to personify the cooperation of a state in the elimination of occupational dis-

ease hazards. Hayhurst was surveying occupational diseases in Illinois and gathering the material for his textbook on industrial health. Alice Hamilton was organizing the science of industrial toxicology. Kessler was building toward a career of outstanding leadership in industrial rehabilitation. Lanza, making the first study of silicosis in this country, was looking forward to organized research into occupational disease hazards and their measurement. Lee was investigating industrial fatigue. Lowe was giving substance to the ideas that have revolutionized physical examinations in industry. McCord was getting ready to express an orderly brilliance of mind in his "Industrial Hygiene for Engineers and Managers". Harry Mock was developing the fundamentals of the organization of medical service in industry, and writing the first book on industrial medicine and surgery to be printed in America. Sappington, the first American to receive the degree of Doctor of Public Health in the field of industrial hygiene, was foreseeing, and preparing himself for, the inevitable indispensability of scientific *medical* foundationing in the experience of the industrial hygienist of the future. Selby was making the first really *searching* studies regarding industrial medical service. Sayers was developing methods for the coordination with medical findings of data concerning occupational disease hazards. Sawyer was realizing the importance of the principles of preventive medicine in industry. Smyth was studying volatile solvents. Watson was bringing to industry the first fully developed diagnostic service and putting it into application. Winslow was perceiving the far-reaching benefits of health administration in industry. Wade Wright was evolving fundamental methods from clinical experience. . . .

TO HAVE come upon these pioneers (and their contemporary trail-blazers who also deserve to be mentioned) while the achievements that now distinguish them were still in the doing, and while they did not yet realize how irresistibly they were bringing industry into 'The Years of the Doctors', would that not have been of surpassing interest?

It would indeed. But the historian then could not have had the advantages of time and perspective, and without them he could not have appreciated the element of greatest interest. For he would not have understood, any more than the men who were doing the work understood, that they were developing the substance and arranging the order of a new science. To illustrate: a few years prior to 1905 Dr. Alice Hamilton became a resident at Hull House, in Chicago. Industrial conditions then were such that 'desperate evidence of the casual and destructive methods of American industry confronted the settlement worker at every turn.' And she 'well remembers the increasing feelings of anger and revolt with which she used to pass the unregenerate Pullman factory in those days.' But no historian, walking with her, could have foreseen, any more than she foresaw, that she, the same Alice Hamilton, would grow to international recognition in the sector of industrial toxicology while, at the same time, one Thomas Crowder, beginning at and with that same 'Pullman factory', would arrive at international distinction in the contiguous sector of industrial sanitation. Such things are inherent in the early years of an era. They greatly enrich the fabric of its annals, but only the retrospective view can bring them out.

Among all the wise preceptors whose counsel and advice were helpful to me, none stands out more prominently in my memory than the sage professor who was forever urging us to 'read biography.' I have followed his teaching, in that respect at least. I have read biography, and, for me, nothing is more interesting. Biographies are little x-rays of history. I wish there were more of them, and more really competent biographers.

Now, Gene, I realize that you don't want advice —usually, you know, worth no more than you pay for it. But let me pass on to you this one injunction: *'Read biography'*. Read everything you can find about the men in our profession, and in our special field. And then, while yet there is time—some of the pioneers in industrial medicine and surgery are getting along in years—go around to Association meetings and get acquainted. What wouldn't you give to have *known* Pasteur, Koch, Ehrlich, Jenner, Hunter, Virchow, Lister?

Well, it's time to sign off, about the 'great days'. After all, the fine new field of industrial medicine and surgery is as old as my experience and as young as your inexperience, and all its days are 'great days'. Here's wishing you a long and happy lifetime of them.

Employee Health Security

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IN THE past there have been numerous more or less haphazard plans of employee health security in industry, called by such various and fatuous names as fitted the natures back of them. This subject is so vast that in this article we will touch upon the subject of health and sick benefits only, and endeavor to point out certain conditions that must be met and altered if benefits of this kind are to meet the needs of the future.

Times and customs are changing—not through any great aid from our state or national governments in their social reforms, but from the natural changes that come with the passage of time and the knowledge that is gained from past performance and experiences. People such as compose the population of the United States cannot be reformed nor can their opinions be revised overnight. Far the greater portion of our nation have tolerant and patient dispositions; and while it may appear that mass opinion is easily swayed by fantastic schemes and social propaganda, that is far wide of the mark, as they peacefully study the plans put forth and after careful analysis make their formed opinions felt.

In the past industrial executives, actuated by humanitarian desires and their feeling for their fellowmen as represented in their particular industry, have put into operation plans of health security for their employees in the form of sick and health benefit insurance. Some of these plans were financed and managed solely by the industry, and the employees received outright gratuitous benefits of so much a week after a period of grace of a few days to a full week of continuous

illness before indemnity payments began. Other companies had benefit associations organized by the employees, who contributed a percentage of their earnings to finance the plan. A third form was a mutual plan to which both the employees and the employer contributed, each giving a percentage of the monthly payroll.

Later years witnessed the entrance of the large insurance companies into industry as the carriers for employee group sickness and accident benefit insurance, for which the employer paid the cost. This form of plan was of two types: one in which the insurance company was the sole administrator of the group plan, and the other in which the company or industry covered had what is known as a self-administered plan, under the direct control of the industry, and with the rules, regulations, and payments of indemnity so flexible that it was able to meet any and all conditions that might arise. The amount of indemnity usually paid was quite small, and insufficient to meet the actual needs of the employee when absent from work on account of illness or injury, and it very seldom, if ever, carried the medical costs, to say nothing of giving any aid toward covering the other essential needs of the employee or those dependent upon him.

Many of the plans of this later form excluded certain types of diseases with no indemnity paid, and time limitations were placed concerning the diseases not excluded, as to how long they would be compensated for. This put an added burden on the employee, for many times he failed to lay aside any money for emergency because he thought that he was secured from sickness by his participation in one or the other type of benefit plans in his industry—only to find out, while in the midst of the mental depression of illness, that he was not only sick, and unable to work, with his income cut off, but also that his benefits were denied him because of some limitation in his policy. This latter phase applies to many sick and health policies that are widely advertised in various newspapers and magazines, and are available at a small premium per year. The average person who buys such a contract is attracted by the small premium, and fails to understand the contents of the policy. The disease coverages are too often vague, and limited in their application to rare disease conditions; but this is not known by the policyholder until he is sick, and then the shock reacts harmfully upon his general condition when he learns no benefits are forthcoming even though he may have carried the insurance for many years.

Many of the existing sick and health benefit plans were organized hastily and with the ultimate design, in back of the humanitarian features, to hold the employees in line in the event of labor disputes, the same as the seniority rights in certain industries and the pension plans in others have been so often used in the past to prevent the cessation of work threatened by strikes. And being something new and of radical departure, these plans were inadequately financed, were without actuarial advice, and were conducted within the various industries by persons young in age and experience and lacking in tact and feeling toward the employees when illness confronted them.

When a person is ill or injured and his or her emotional state is in a jumbled condition is the time when there is need for sympathy and kindly contact by those directing sick and health benefits. Impressions made during illness and suffering are generally more lasting than any other form of impression found in the employee-employer relation. But it seems characteristic that those in authority in relief plans assume a cold and dictatorial attitude toward the unfortunate whom they are supposed to serve in time of need and suffering. Why do they do this?

There are two answers to this question. Many are unfitted mentally to meet the situation, and, lacking experience in handling people, they are tactless and speak and act in a manner that impresses upon those seeking relief the idea that they are doing them a great favor in listening to their troubles. Again, a good many have a suspicious attitude, and build up a resistance complex against those in other classes of life than their own. Some of the official and organized charity workers administering relief and benefits are of a higher education and come more from the "leisure class," hence they cannot see or understand the troubles of those less fortunate.

THE great concern prevalent in industry during the past six years on account of the national economic depression has resulted in the activities of quite a few sick and health benefit groups being curtailed or even suspended on account of the costs. But such costs have not been due to the payments for actual disease, as, during the depression, we have had a remarkable freedom from epidemic disease, and the death rate has been the lowest in years. The real reason for the financial embarrassment of numerous sick and health benefits set-ups has been, almost entirely, the looseness with which they have been operated and the false sentimentality that has so often characterized their sick and health benefit payments.

Those industries that have a well thought out policy of compensation, and whose employee sick and health group insurance has been put on a business basis, with human justice to the employee, have been able to operate their plans successfully throughout the past six years.

Too much theory, and not enough practical effort, have been put forth as to just how best to conduct the group sick and health insurance. The first essential fact to be carried in the minds of all the personnel, from president down to water boy, is that every penny that is paid out for employee indemnity comes out of the treasury of the industry, and should this be wasted — through fraudulent claims, or laxness in checking up absenteeism—this waste is the same as if someone stole a like amount from the sick and benefit fund.

The fundamental purpose of a sick and health insurance benefit fund, of course, is to provide an employee with some income, no matter how small, that will give him the means of financial aid until he can be returned to his regular work and his regular income. But we must not lose sight of the equally important factor of intelligent conservation of the funds of the sick and benefit association. Being conducted on a business basis does not mean that injustice need be done to any employee. A clear and sympathetic study of each claim filed, and the disposition of the claim under a set system of rules and routines, will make for better employee relations and prevent much misunderstanding, to say nothing of financial loss.

For the best interests of both employer and

employees it is well to have the weekly indemnity of sufficient amount to be a real aid in time of illness and not too high to defeat the basic fundamentals of insurance. I know where some indemnities are paid that are in excess of the employees' regular rates of pay, and so considerable trouble is found in preventing certain employees from going on the sick list, since they get more while being ill than when they work. When a condition of this kind prevails it penalizes the older group of employees, because no matter if the employee has a service of one year or 30 years his indemnity will be the same. The low-paid employee often draws the same amount of indemnity as his co-worker in the high-wage bracket, while at the same time the skilled artisan receives no more indemnity than the unskilled laborer.

The solution should be in having two or more classifications of indemnity, so that when sickness is present the man whose income and expenses of life are low will be taken care of in one classification, and the one whose income is greater and who thus suffers the greater loss will be taken care of in a second classification. Close observance must be had of rules governing the filing of claims for illness.

The procedure and routines herein described are from the author's experience in personal supervision of, and affiliation with, the employees' sick and health benefit insurance of a large utility company whose insurance loss ratio has been less than 50% of the yearly premium paid, with the exception of the years 1933 and 1934. The number of employees' claims paid weekly has averaged 40 during the past six years; this is for 4800 employees. The weekly indemnity paid is $20 per week for 26 weeks.

WHEN an employee becomes ill he, or some member of his family, at once notifies the employee's immediate supervisor. In turn the sick employee's name will appear on the following day's "daily-absentee-from-work-on-account-of-sickness" report. This report is sent to the Medical Department and, from the information given, the report is checked on three subsequent days. Should the employee's illness extend into the third day, he then fills out and sends to his immediate supervisor a "disability notice" card. The supervisor checks and initials the card as to date last worked, sending it, then, direct to the Medical Department where, upon receipt, a doctor telephones the attending physician whose name is on the card. The nature of the employee's illness thus given is verified by his doctor, and a prognosis is made as to the length of time the employee may be away from his work. On the morning of the fifth day the doctor or the patient is contacted by telephone as to his continued illness, and if there is no cause to believe that the patient is not genuinely disabled at home on account of illness, the weekly indemnity starts on the morning of the eighth day of illness. Nothing is paid for the first week's illness. Sometime during the second week of illness the visiting nurse calls upon the patient to give whatever aid or advice may be requested by him, and she in turn reports to the chief surgeon and the insurance clerk the state of the employee's health, and aids in keeping the sick records accurate by means of the real facts surrounding the employee's illness. Once a week a contact is made with the attending physician in order to ascertain the employee's progress; and invoice checks are sent to the employee weekly.

When the employee is able to be out he is required to make a weekly contact with the medical department; and when, in the opinion of his own physician and the medical department, he is able to resume work, he calls at the medical department for a thorough examination, and if found to be fit to resume work with safety to himself and those about him, an "OK" is given and he receives his final payment. He in turn presents his "OK-for-work" report to his immediate supervisor; and he is then eligible to return to active duty.

To be Filled out by Employee

Disability Notice

Dis. No. ____
Clm. No. ____
For Office Use Only

Failure to send this notice within three days may jeopardize your insurance claim

1. Print Your Name _____ Pass No. _____
(Last First Middle)

Address _____ Phone No. _____
(Number Street City or Town)

Occupation _____ Married { Yes / No

Department _____ Division _____

2. What is Your Sickness or Injury? _____

_____

3. Date first unable to work because of **this** Sickness or Injury:

_____
(Day of Month Month Year)

4. Name of Doctor Attending _____

Doctors address _____ Phone No. _____

IMPORTANT—If you have been **UNABLE TO WORK** on account of sickness, or if injured while off duty, **FOR MORE THAN THREE DAYS** send this notice **AT ONCE** to your **SUPERINTENDENT** or **FOREMAN** who will transmit same to Medical Department, Chicago Rapid Transit Company.

EMPLOYEES MUST NOT WRITE ON **THIS** SIDE OF CARD

Date Received _____

Date of Employment _____

Date	Disability	Duration

Previous Claims

Remarks

Is there any additional information? _____

No employee is allowed to resume work of any kind after an absence of five days unless he first secures from the medical department an "OK" after examination. An employee may receive indemnity for 26 weeks for the same disease or sickness only once. *This requires careful initial diagnosis.*

This company has had an annual periodical medical examination of all its employees for the past 23 years, and the medical record of each employee on file in the medical department gives an excellent forecast of what to expect in sickness frequency and security. Those employees who fail to send in their preliminary notification cards, or who violate or ignore the rules governing the payment of sick claims, forfeit their right to indemnity.

Fraudulent claims have been conspicuous by their absence in the past 10 years, and employee

cooperation has been excellent. No suit for payment of claims has been filed against the company since this self-administered group protection has been in force.

The attitude of the medical profession generally has been cooperative; doctors have shown a willingness to get the patient back on his feet as an economic factor in as short a time as possible with safety to the employee and the company. There have been exceptions, of course, and some doctors, who were antagonistic to insurance carriers from some past grievance have failed to cooperate, and have had the tendency to encourage the employee to remain off as long as he desired, and to get all the money he could out of the insurance company. When it was explained, however, that ours was self-administered group insurance, with the Rapid Transit Company footing the entire bill, the antagonism was eliminated and the family doctors were willing to cooperate. One cannot criticize these few doctors, for we are all aware of some of the abuses in the past and the difficulties encountered, especially in accident cases covered by insurance carriers, in their relations with doctors.

TERMINATION OF CLAIM

Claim No.....

Date.....

Mr. .....employed as.....

in the.....Department of the.....Division

who has been absent from his duties since.....

on account of.....

He has been examined by the medical department and found fit or unfit to resume his duties because.....

.....

Claim Terminated.....

Signed.....M. D.

SECOND EXAMINATION:

M.D.

THIRD EXAMINATION:

M.D.

The security of any plan of sick and health insurance in industry is predicated upon the routines in effect to identify the claimant's illness and be sure that his period of absence from the company is solely due to his illness. Payments for continued alleged illnesses are a waste of the insurance funds; such payments increase the loss insurance ratio and in time are reflected in higher premium costs.

The success of this particular company in its benefit insurance plans has been accomplished despite the fact that the average age of the employees in this group is 47.29 years, and the average age length of service is 17.07 years. The death rate for the past decade has been 70 deaths per year, and the average age at death for all 57 years.

IT IS needless to call to attention the present attitude of the Federal government in its desires for social reform as to both the health and the economic security of the people. Plans have been formulated looking toward unemployment insurance, and pensions for those past a certain age, and sick and health insurance for all. Any and all of such social reforms must depend upon industry for success. The need and the agitation for these reforms are based upon the lack of any definite plan put forth by industry as a whole in the past or at present. The time is at hand when each industry must broaden its attitude, and formulate plans that will fit its particular employee needs for health security.

The costs of these security plans do not entail a great outlay of money, provided they are based on sound financial principles and supervised by competent and trained personnel. If this is done the waste will be eliminated, and the cost of maintenance of health security will be kept within reasonable economic bounds.

The health of employees in industry is directly reflected in the cost of operation and the perfection of the product or commodity produced. Healthy employees usually are safe and efficient workers. Eliminate the costs of accident and litigation resulting from injury and the money available for profits to both employees and stockholders will be greatly increased.

In the past industry has taken for granted that accidents must occur, despite all precautions to prevent them. Too little thought has been given to the important factor that maintenance of men in industry is not a charitable justice on the employer's part, but a valuable asset as against the costs of accidents and sickness. Time and space do not permit of going into all the many and varied phases of employee health conservation and its direct effect upon successful industrial protection. But in general the influence of proper plans upon sick and health insurance procedure will be a vital necessity with the resumption of industrial activity. And the customs that were prescribed in the past will not meet the changing times or the needs of the future. Elimination of all ulterior motives in back of employee relations as in the past, and an earnest effort to assure health and economic security for them in the future will be the firm basis on which we will be able to prevent legislative or trial reforms by governmental regulation.

MEDICAL EXAMINERS REPORT

NAME **CLAIM NO.**

ADDRESS **DATE of FIRST DIS.**

NAME of ATTENDING PHYSICIAN

Signs—Symptoms—Diagnosis:
Prognosis and Probable Sequelae:
Length of Total Disability

DATE

RECORD OF PAYMENT

Name ..... **Claim No.** .....

Date Benefit Started **Approved for Payments:**

	From	To	Days	Med. Dir.	Date	Amount	Draft No.	Est. Future Dis.
1								
2								
3								
		★	★	★	★	★	★	
24								
25								
26								

Total Period of Disability Benefits.....**weeks**.....**Days Amt. $**.....

Date Closed .....

Industrial Diseases and Accidents

—VIIth International Congress, Brussels, July, 1935—Review of Subjects and Speakers; Summaries of Papers—

THE VIIth International Congress on Industrial Accidents and Diseases was held at Brussels, July 22-26 inclusive, 1935, under the chairmanship of Dr. D. Glibert, the Secretary-General being Dr. Leo DeJardin.

The work of the Congress was divided into three sections:

SECTION A, on Surgery, which considered the subjects of "Remote Consequences of Skull Injuries," and "Hand and Finger Injuries";

SECTION B, on Industrial Medicine, which included the subjects of "Combating Industrial Dusts," and "The Pathological Effects of Gases Escaping from Fiery Seams;" and the so-called

JOINT SECTION in which was presented a discussion on "Pain," and "Injuries Caused by Electricity."

Surgery

IN THE section on Surgery, in the symposium on "Remote Consequences of Skull Injuries," the following reports were made:

"The Effects of Head Injury Remaining After One Year," by Dr. C. P. Symonds, of London;

"Morbid Anatomy," by Drs. M. Arnaud, of Marseilles, and Yves Poursines, of Beyrouth;

"Pathological Anatomy of Post-traumatic Headache," by Dr. Wilder Penfield, of Montreal;

"Diagnosis, Prognosis, Assessment," by Dr. Adrien Lippens, of Brussels; and

"Treatment," by Drs. A. Oller and E. Escardo, of Madrid, and Dr. Paul Martin, of Brussels.

Also in the section on Surgery relating to the symposium on "Hand and Finger Injuries," the following reports were made:

"Immediate Treatment," by Drs. Neuman, of Brussels, and Lorenz Bohler, of Vienna;

"Infectious Complications," by Drs. C. G. Yersin, of Payerne, and Arthur Buzello, of Duisburg;

"Self-inflicted Injuries to the Hand and Fingers," by Drs. Salvatore Diez and Aprosio, of Rome;

"Curative Operations," by Drs. Charles Lenormant and Marc Iselin, of Paris;

"Trophic and Painful Sequelae," by Drs. Rene Leriche and Rene Fontaine, of Strassbourg; and

"Diagnosis for Compensation Assessment," by Drs. Leon Imbert and Jean Paoli, of Marseilles.

Industrial Medicine

IN THE section on Industrial Medicine, in the symposium on "Combating Industrial Dusts," the subjects and speakers were as follows:

"Dust Sampling and Dust Counting," by Drs. E. L. Middleton, of London, and Bordas, of Paris;

"Comparative Value of the Different Means of Combating Industrial Dusts." by Dr. L. Deladriere, of Brussels, and Drs. E. Boerma, F. Groeneveld and W. R. H. Kranenburg, of The Hague;

"Criteria for Selecting Prior to Their Engagement, Persons Who Will Be Exposed to Dangerous Dusts," by Drs. L. Teleky, of Vienna, and G. Pieraccini, of Florence; and

"First Symptoms of an Intolerance of the Dangerous Occupations," by Drs. A. Policard, of Lyons, E. Martin, of Saint-Etienne, and Denet Kravitz, of Obourglez-Mons.

Also in the section on Industrial Medicine, relating to the symposium on "The Pathological Effect of Gases Escaping from Fiery Seams," papers were given as noted:

"Nature of the Gases Escaping from Fiery Seams; Detection and Prevention," by Drs. A. Breyre, of Paturages, and F. Leprince-Ringuet, of Paris; and

"Physiological and Pathological Effects," by Drs. R. R. Sayers, of Washington, Ferdinand Flury, of Wurzburg, Yandell Henderson, of New Haven, and E. Hautain, of Fontaine-l 'Eveque.

Joint Section

IN THE section on mixed questions, or so-called Joint Section, there was first a symposium on "Pain," with the subjects and the authors as follows:

"Pathological Alterations of the Sense of Pain," by Drs. O. Crouzon and Jean Christophe, of Paris; and

"Objective Diagnosis of Pain in Injured Persons," by Dr. Maurice De Laet, of Brussels.

Also in the section on mixed questions, there was a symposium on "Injuries Caused by Electricity," the following subjects and speakers being noted:

"Pathological Troubles," by Dr. G. Aiello, of Milan;

"Prevention," by Dr. Stefan Jellinek, of Vienna;

"Morbid Anatomy," by Dr. C. Wegelin, of Berne; and

"Electrical Injuries," by Dr. Stassen, of Liege.

Summaries of these various communications have been given in French, German, Italian and English.

Skull Injuries

ETIOLOGY AND SYMPTOMATOLOGY. The communication is based upon the records of 99 patients with head injuries of civil life. All were patients with closed injuries examined by the writer not less than one year after the accident, and presenting various symptoms at that time.

The principal symptoms are tabulated. In the cases involving questions of outstanding compensation, objective symptoms (epilepsy, aphasia, optic atrophy) were only half as frequent as in the non-compensation group. Of 26 cases of traumatic epilepsy, 23 were in the non-compensation group. This is chiefly because traumatic epilepsy is a late complication and often occurs after the compensation has been settled. Mental changes occurred in 25 patients, of whom 14 showed defects in memory tests. Eight of these also showed changes of personality. Conduct disorder was

observed mainly in children or adolescents. The degree of memory defect in cases uncomplicated by recurrent injury, aphasia, or previous mental abnormality was never completely disabling. In two instances an attack of mental depression appeared to have been precipitated by the injury, and in one case a paranoid state developed.

Analysis of the cases of traumatic epilepsy shows that in the majority of cases fractures of the skull was proved by x-rays. The average duration of unconsciousness after the injury in the patients who afterward developed epilepsy was unusually prolonged (average 9-1/2 days). A long duration of unconsciousness therefore probably indicates an increased risk of epilepsy. The average latent interval between the injury and the first epileptic attack was two years and nine months. In the great majority of cases the attacks were of a generalized and of a Jacksonian character, the commonest occurrence being at first minor, and later major, attacks.

Traumatic aphasia in three out of four cases was totally disabling. The question of the nature of the injury in these cases is important in relation to the possibility of surgical treatment.

Anosmia, though usually clearing up within a year, occurred in five cases. Optic atrophy also occurred in five cases, and was unilateral in all. The pathology of these two sequelae is discussed, together with affections of the other cranial nerves. Other symptom complexes include those of brain-stem lesions, hydrocephalic attacks and cataplexy. Headache and giddiness are frequent symptoms. The latter is probably in most cases due to labyrinthine damage. The clinical varieties of giddiness are discussed, and a distinction made between the symptoms of labyrinthine disorder and those due to disturbance of vasomotor function.

B. Morbid Anatomy. In order to understand the facts, it is essential to follow the evolution of the injuries from their production onward up to the later date which forms the subject of the report.

Thus, following a rapid survey of the *typical evolution* of the simplest skull and cerebral traumatisms from injuries occurring in the case of normal tissues and progressing in accordance with experimental findings, the reporter turns to those anatomical occurrences which are habitually met with in complex abnormal cases, and which traumatic injuries in a human subject constitute in practice.

Contusions, hemorrhages and concussions are studied in turn from the point of view of their anatomical development.

While from the anatomical point of view sequelae constantly occur, being confined to scarification from the past injury in the absence of clinical symptoms, more frequently anatomical-clinical sequelae exist corresponding to typical accidents of first importance.

The characteristic of anatomical sequelae from injuries is their *latency*, development depending on diverse physio-pathological conditions occurring at times after much delay and following a variable course which is still very difficult to determine.

It is clear that this evolution is subject to reciprocal interaction of the injuries on the functions and *vica versa* (action of the vegetative centers, part played by the vascular system). Thus it might be stated that a skull injury constitutes essentially a *psychopathological injury*, the anatomical consequences of which follow an intermittent evolution—a veritable progress in stages—at times developing and at times regressing, an evolution which finally may be said to be governed by various physio-pathological demands, a study of which is outlined in the report. But it is not only the mutual repercussion of injuries to the parenchyma on the cerebral functions which influences the evolution and organization of the sequelae of such injuries; disorders affecting the spinal fluid, changes in the circulatory system of the brain brought about by complex irritant agencies (adhesions, injuries of the labyrinth, ventricular dislocations, injuries of the vegetative center) are of considerable importance in this connection.

All these facts go to explain that while the sequelae of such injuries may be studied on a true anatomical basis, it must not be forgotten that other sequelae, and these not the least important, are influenced by important functional changes which at the present time it is not always possible to connect with an obvious histological injury.

Pathological anatomy of post-traumatic headache. Headache and dizziness constitute an important sequel to head injury which has a definite organic basis and for which a specific therapy (intraspinal insufflation of air) was described by the author in 1927.

An analysis of all the sensitive areas within the cranial cavity is presented, the information being derived from neurological experience of craniotomies done under local anesthesia. The analysis indicated that the pain of this condition must be conducted along the arteries of the dura mater. Furthermore, for the purposes of this communication, patients with post-traumatic headache have been studied by encephalography, by direct trepanation and by microscopical preparations of specimens of excised meninges.

The pathological cause of the condition is adhesive closure of the subdural space. Because of this adhesion the brain exerts traction, and perhaps pressure, upon the sensitive under-surface of the dura. If air be caused to enter the subarachnoid spaces and kept out of the ventricles so that the latter may collapse, it (the air) usually breaks through into the subdural space where it may be demonstrated by x-ray from the second to the fifth days.

The hypothetical mechanism proposed is that the original blow on the skull injures the underlying dura and results in an out-pouring of a very thin layer of exudate and blood into the subdural space. The fibrin thus liberated cements the two membranes together and they remain feebly but effectively attached long after the red blood cells have disappeared.

C. Diagnosis, Prognosis, Assessment. The author refers to the difficutly of accurate diagnosis, but also to the possibility offered by thorough and specialized examination of a patient under observation (ophthalmological, cochlea-vestibular, neurological, psychiatrical, encephalographical and biological examinations).

The first chapter deals with:

Paralytic conditions, the area of distribution of which exceeds that of anatomic loss of power to which it has been the custom to assimilate it.

Abdominal reflexes, that of Leva, affections of the diaphragm, bladder, rectum, etc., to help to determine the area involved. The intra-cranial anatomic condition revealed by encephalography, often and notably, the extent of a wound which is of importance in the study of post-traumatic epilepsy.

Detection of slight initial motor disturbances and unknown lesions, either of the *skull* (fractures, decalcification, hypercalcification, etc.) or of the *brain* (arachnoiditis, sub-arachnoid hematoma, aneurism, calcifications, etc.).

Coma is by no means an infallible symptom at the outset of an injury of the skull or the brain existing in 15% of the injured; a third of these suffering from fracture of the skull, even with denting of the surface, did not suffer from loss of consciousness.

The second chapter is devoted to retarded moderate symptoms which, on the whole, constitute the concussion syndrome caused by actual injuries and, in primordial order, by the sequelae of vascular micro-traumatisms, gliomatous tracts, small foci of pachymeningitis, neuro-vegetative and vasculo-spasmodic inhibition phenomena.

Neuropathies are therefore excluded in this conception, which restricts the picture to "traumatic neurosis," a very loose term likely to lead to confusion and error.

In the concussion syndrome it is essential to determine the origin of headache and vertigo, almost always noted at the beginning. Attacks of headache of the well-known type of sick headache are influenced by the position of the injury, by the slightest toxic phenomena, accompanied by circulatory and vasomotor disturbances.

Of the manifestations of vestibular hyper and hypo-excitability: the former is an early and characteristic sign and an indication of circulatory derangement. All other affections, even psychic affections, are connected with disequilibrium of the vagosympathetic system. It would take too long to enumerate them in the space available here.

Measurement of the diastolic tension of the central artery of the retina is an important element in diagnosis, but it is not pathognomonic. Pressure and changes in the composition of the spinal fluid are inconstant, but are of undoubted value when, like the tension of the retina, they are compared with the general tension and the venous tension.

Prognosis appearing to require the greatest reservation is not always that which follows the gravest course, and, inversely, concussion patients show less of power of adaption than those suffering from injuries providing a safety valve. Age and affections of the circulation play a large part in the reservation required when making prognosis.

Assessments are dealt with in a final chapter which it is impossible to summarize.

D. Treatment. 1. The evolution of traumatic injuries of the skull may be divided into three periods: (a) acute period of extreme gravity; (b) after disappearance of acute symptoms up to the lapse of a year after the accident; (c) subsequent period.

2. This division into three periods corresponds rather to a clinical reality than to necessities imposed by legislation; according to legislation, such cases are automatically considered as permanent incapacity after the lapse of a year from the time of the accident.

3. The present study is concerned with cases corresponding to the second period; this second period may in turn be subdivided as follows: (1) cerebral contusion; (2) function derangements; (3) traumatic epilepsy; and (4) traumatic apoplexy.

4. There are no very precise indications in regard to surgical treatment except in cases of epilepsy or injuries to very localized foci, and often it may be avoided even then, provided that medical treatment is actively applied from the immediate outset.

5. Medical treatment should be based in the first place on very accurate diagnosis. It should be stated that encephalography should not be reverted to except in very definite cases, since it does improve the condition of the patient, but, on the other hand, may aggravate the evolution of the disease.

6. Medical treatment should in each case be based not only upon symptomatology, but also on very intensive psychotherapeutic study.

The reports of medical assessors are also of importance in regard to prognosis and the compensation accorded. Weighty consideration should be given to the medical report, and compensation should in general not be excessive. Usually we discharge the patient three or four months after the accident, and, in cases where there are sequelae, benefit for partial permanent incapacity for the occupation in question, consisting of 25% of the compensation allowance, is accorded. In this manner it is possible to contribute to therapeutic treatment which is more favorable to the worker.

IN REGARD to certain sequelae of cranial traumatic injuries, no question whatsoever arises as to treatment in certain other cases, on the contrary, hesitation between medical or surgical treatment occurs, and in yet other circumstances there is still no clear opinion as to the best type of treatment.

1. *The retarded concussion syndrome*: The simplest means are first applied; rest, isolation, sedatives, eventual intravenous injection of hypertonic serum or distilled water. In more serious cases not yielding to simple therapy, lumbar insufflation of air is resorted to.

The author asks if, in such resistant cases, where encephalography reveals the existence of an important cerebral scar, excision of this scar should not be effected?

2. *Arachnoidites and arachnoid cysts*: When encephalography reveals the existence of these injuries, there should be no hesitation about surgical intervention.

3. *Chronic sub-dural hematoma*: Following an attempt at medical treatment (antiepileptic medicaments, drugs for modifying the tension of the spinal fluid, diet) surgical treatment must be resorted to, consisting, according to the circumstances, in extirpation of the periteal scar or in excision of the epileptogenous area.

4. *Paralysis*: Forms of paralysis justify physiotherapeutic or orthopedic treatment. In cases where examination reveals an injury liable to provoke paralysis (chronic hemotoma, arachnoid cyst) surgical intervention is indicated.

5. *Contractions*: Physiotherapy must be re-

sorted to. Orthopedic operations or the wearing of apparatus are at times indicated. Surgical treatment of contractions does not so far seem to be thoroughly satisfactory.

Hand and Finger Injuries

IMMEDIATE TREATMENT. Chapter I. The paths of propagation of infection are the cellular tissue and the tendon sheaths.

Physiopathology of injuries. After a latent period, the injuries become the seat of two important phenomena: *autolysis,* an ideal medium for the rapid multiplication of germs, and *migration of white corpuscles from the blood vessels.* Hence the necessity for excising tissues in process of mortification as an initial treatment of the injuries.

Bacteriology of the injuries. The microbial flora of a wound must be studied both from the aspect of quality and quantity.

Chapter 2. *Treatment of injuries in general.* The treatment of wounds varies according to the nature of the injury, its extent, and the organ affected, bite, cut, contused wound, crushing, tearing, burn, etc.

Immediate suture.

Retarded suture.

Chapter 3. *Treatment of wounds of the hand and fingers.*

Chapter 4. *Injuries to the tendons—indications as to suturing of tendons.*

Section of extensor tendons should be treated by *immediate suture.*

Flexor tendons should be sutured as a secondary treatment when the section occurs at the level of the fingers. Immediate suture may be effected with success in the upper palmer region.

In the zone of the arches at the level of the metacarpophalangeal articulations, it is preferable to abstain from this action and have recourse to suturing only as secondary treatment.

Chapter 5. *Injuries to the fingers.* The nerves of the hand and fingers should be sutured in case of section, despite their tenuity.

Suture should be effected in accordance with precise rules of technique, comprising accurate placing, exposure of the healthy parts of the wound, and bringing into accurate position the segments of the nerve.

Chapter 6. *Injuries of the joints.* Each section of an extensor tendon at the level of the metacarpophalangeal articulations and the finger joints involves, in the majority of cases, an immediately underlying synovial wound.

Prophylaxis of traumatic infections of the joints consists firstly in freeing the articulation from all elements of infection (foreign bodies, earth), in excising the edges of the damaged capsule, and killing the nerve, and finally in carrying out immediate suture after washing with ether.

When the wound has been contracted more than 48 hours previously, and definite clinical signs of arthritis exist, closing of the articulation must be guarded against, and placing in a horizontal position without suturing should be the rule.

DESCRIPTIONS of possible sequelae of open wounds of the fingers and hand in general and, in particular, of open fractures of the fingers and of the metacarpal, involve death by infection, the loss of the whole arm or hand by infection, the loss of the finger affected, on account of the gravity of the wound or on account of infection, local infection at the point of fracture with formation of fistulae and sequestra, pseudo-arthrosis, vicious union of the fractured fragments, affections of the joints of the wounded fingers, and of contiguous fingers and of the whole arm, nervous and vascular troubles, muscle wasting, and vicious scarring.

In the latter half of 1934, all cases of finger and hand wounds which came for treatment—totalling 1886—were carefully examined and followed up. There were 1136 cases of recent open wounds of the fingers and hands, 155 of which consisted of recent open fractures of the finger and of the metacarpal. There were treated besides: 291 cases of recently closed wounds of the fingers and hands, 89 of which were healed bone fractures, then 296 cases of infected wounds, 122 cases of long-standing open wounds of the fingers and hands without infection, and 41 cases of long-standing closed wounds of the fingers and of the hands.

Recent open fractures heal without trouble when an adequate incision is made and the skin sewn together, but only the skin. There is thus obtained a closed fracture which is treated and left at rest until the open fragments are solidly joined in the correct position. In order to prevent muscular wasting and ankylosis, it is essential from the very outset to induce complete movement of the unaffected joints, avoiding the causation of pain.

By this means there is obtained good irrigation by the blood, and rapid healing.

Infected fractures require absolute rest without interruption in the absence of pus. Where there is pus the wound should be completely opened with application of a tourniquet and anesthesia; thereafter the limb is left completely at rest.

The wounded limb should be raised to assure good irrigation.

Observation of the above principles has resulted in the healing without further trouble of 148 out of 155 (or 95.5%) open wounds of the fingers and of the metacarpal. In seven cases with sequelae, technical faults were the cause, treatment having been applied by inexperienced people and without sufficient control. Age, constitution and occupation were not proved to have any appreciable influence on the healing process.

The average duration of treatment up to resumption of work was, in cases with conservation of the fingers 44 days, and in cases of amputation 50 days.

Out of 98 cases in which the fingers were saved, 85 (or 86.7%) healed without trouble, that is to say without affecting the mobility of the joints and with healthy scars, and of the 57 cases of amputation 49 (or 85.9%).

The "Arbeiterunfallversicherungsanstalt" of Vienna paid out in 1911, in round figures, a sum of 16 millions in compensation, five millions of which were granted for wounds of the hands and fingers.

It is, therefore, worth while to direct attention to wounds of this nature.

Guiding principles for avoidance of sequelae: training of medical men in the treatment of such injuries; indication of the responsibility involved from the moment first-aid is applied and during

subsequent treatment; calling of attention to principles likely to involve faulty healing and to cause the importance of wounds of the hand and fingers to be underestimated, such as refusal of admission of victims of such wounds to hospital on account of lack of space and time, leaving treatment of such cases to the youngest and least experienced doctors.

B. INFECTIOUS COMPLICATIONS. History and bibliography have been intentionally omitted, the report in question providing the most up-to-date information on the subject.

Professor Buzello, Joint Reporter, deals with the bacteriological problem and that of specific infections, and Dr. Yersin with non-specific pyogenic infections under the following headings: Nomenclature, Definition, Classification, Treatment.

The report is based on 10,000 personally investigated cases, and provides the following conclusions:

Nomenclature, so far very confused, has been predicated on historic and traditional acquisitions, and requires simplification on the basis of pathological anatomy and pure clinical findings; standard international nomenclature should be universally adopted.

Definition of the infection must have, as its unvarying basis, pathological anatomy and the Pasteur theory, completed by biological theory.

Classification takes into account the infected organs, and utilizes the terms dermatites, cellulites, myosites, tenosynovites, osteites (septic). Clinical development is characterized by the terms abscess or phlegmons.

Treatment consists in the modern application of the old surgical adage: *"ubi pus, ibi evacua."*

THE hand, as the prehensile and tactile organ of man, is, with the brain, the most important part of the body from the point of view of work and the needs of daily life. It is for this reason that the hand is especially exposed to wounds and injuries in the course of work. Infectious complications and injuries to the fingers and to the hand are of extremely frequent occurrence and the treatment of these is highly important.

Every medical man meets almost daily with infections of the finger and of the hand in consequence of accidental injury. Treatment of these requires competent handling and reflection. Only the doctor who understands the anatomicopathological causes of the inflammation, its clinical picture and the present methods of surgical treatment, is capable of understanding and treating acute infections of the fingers and of the hand.

The report deals with local and general states of infection and the theories at the bases of these, followed by an account of acute infections of the fingers and of the hand. With regard to each of these, a description is given of the anatomicopathological basis, and the clinical picture assessment thereof as the consequence of an accident and treatment.

The most frequent infections of the fingers and of the hand following injuries and accidents are whitlows of various types and phlegmon of the tendon sheaths. On this account these conditions are treated in detail in the report. Other acute infections, osteomyelitis, erysipelas, erysipeloid and various other specific infections, are discussed in their relation to wounds and lesions of the hand; and tetanus, rabies, diphtheria, anthrax infection—the latter, though infections of a general nature, not infrequently give rise to wounds and injuries following on accidents. Reference to all possible infections and complications of the injuries in question is impossible, and attention has been confined to the most frequently occurring acute infections with an outline of the anatomicopathological picture of the requisite treatment.

The risk of infection of a wound affecting a worker's hand and endangering his life is frequent and necessitates that wounds of this kind should receive serious consideration. An accidental wound or injury to the hand which is neglected or inadequately dressed is almost invariably followed by complications involving prolonged incapacity as regards use of the hand. Any infection of the fingers and the hand following on an accidental wound or injury constitutes a serious problem for the surgeon. It is essential to conserve the important tissues of the hand, to aim at restoration of the working and functional capacity of all the fingers, and to ensure the earliest possible resumption of work. The medical man called in to treat infections and accidental lesions of the type in question, requires to bring into play all his medical knowledge and judgment. By supplying adequate treatment he may render the greatest service to the patient and contribute to rapid restoration from the point of view of working capacity and use of the injured member.

C. SELF-INFLICTED INJURIES TO THE HAND AND FINGERS. The author, after giving a general account of the phenomenon of self-inflicted injuries in industrial accidents and having indicated the causes and remedies, reviews the most frequent self-inflicted injuries of the hand, referring more especially to cutting of the tendons, and phalangeal and metacarpal fractures. Cutting of the tendons almost always affects the extensor muscle of the thumb at the level of the "snuff box" depression (tabatiere).

The accident to which the injury is ascribed is generally striking the hand against glass, or a fall while holding a glass contained in the hand. The author gives an account of all the clinical factors capable of providing medicolegal diagnosis of self-inflicted injury and describes cases (36) which he has observed in his capacity as medical expert.

AS REGARDS self-inflicted fractures, the author explains the method he has recommended since 1927 with a view to revealing fraudulent mutilation and which he has used on numerous occasions when called on for expert opinion. The various observations he has made during the period of 10 years in regard to fractures of the fingers demonstrate the existence of special characteristics of the skeleton or of the soft parts which, given a certain type of fracture, enable the traumatic mechanism which produced it to be determined, and facilitate differentiation between one causal agent and another. These characteristics by their constancy may be termed specific for each cause or agency.

Consequently, the method recommended by the author consists in confirming that the fracture stated to be the result of an accident may or may not be due to the accident alleged after having established by what mechanism such an accident may cause fracture of the fingers.

The author provides a synthetic summary of 49 cases of fraudulent fractures.

D. CURATIVE OPERATIONS. Operative rehabilitation of long standing mutilations of the hand and finger constitutes an interesting but difficult chapter in the history of reconstructive surgery. It would never be possible to lay down systematic rules, since each particular case implies treatment on peculiar lines.

From the economic point of view, its application cannot be generalized, especially in regard to industrial accidents, since it necessitates prolonged and costly treatment and often repeated intervention, with considerable steady collaboration on the part of the patient, and that with a view to obtaining a result which is always uncertain and at times incomplete. Yet in well selected cases it is capable of providing inestimable functional recovery, more particularly in those occupations requiring more agility and precision than strength in the use of the hand.

From the point of view of technique, the report is restricted to those points in regard to which the reporters' personal experience has enabled them to furnish certain new details.

1. As *regards repair of the tendons*, only retarded intervention subsequent to scarification guaranteeing the asepsis indispensable to success should be given preference. The three processes of reconstitution, consisting of tendon-reinsertion, reintroduction and grafting, should be taken into consideration, each finding its application in accordance with the location and extent of the loss of tendinous substance. Systematic reconstitution of the second "pulley of reflexion" of the flexors by means of aponeuritic grafting is likely to provide perceptible results.

2. For *repairing loss of cutaneous substance*, grafting with thin free strips (Reverdin, Ollier-Thiersch) and grafting with very small patches (Davies, Alglave) are only of utility in the case of very limited injuries in an area not subject to frequent pressure. In all cases of loss of substance, however restricted, the surgeon is limited to a choice between free grafting of the total skin (Krause) or various pediculated auto-plastic applications. The first method has the advantage of being carried out at one sitting and under cover of strict asepsis, but it is often spoiled by partial disintegration of the graft. Auto-plastic applications necessitate repeated operations, accompanied always with a certain inevitable amount of infection. They are, nevertheless, undoubtedly to be indicated, particularly in those cases in which there is necessity for eventual repair of the deep-seated organs (tendons) and also in cases involving loss of substance from the back of the hand.

3. Among *the processes for reconstitution of the thumb*, the best are considered to be: cutaneous auto-plastic application with or without bone grafting where it is desired to obtain a sufficiently long and mobile support; grafting of the first finger with its metacarpal on to the thumb (two cases in the authors' personal experience being referred to in the report) where it is desired to obtain a mobile thumb opposite the other fingers.

E. TROPHIC AND PAINFUL SEQUELAE. 1. Functional post-traumatic affections of the hand and fingers present varied clinical pictures, the most dominant feature being:

(a) painful phenomena either in the form of diffused pain or causalgia (burning pain);
(b) contractions;
(c) hard sub-cutaneous oedemas;
(d) osteoporosis;
(e) cutaneous trophic affections;
(f) vasomotor disturbances.

2. *Oscillometric examination* reveals as the origin of these affections vasomotor changes caused by the traumatism and later on maintained by scarification. The above forms are in most instances not distinct but mixed, a number or all of them being present in one degree or another in each case.

3. *A unique causal agency* of the functional derangement calls for a unique system of treatment.

At the beginning, local injections around the injured area or under the scar, less frequently along the collateral digital nerves, bring about improvement often surprising in extent, but the treatment must be persevered with for a long time to attain ultimate success.

Anesthesia of the stellate ganglion may complete, or be used in substitution for, treatment in case of failure, and, if that fails, surgical operation must be reverted to.

4. *Operations on the sympathetic are indicated as the best means of treatment in such cases*, being thoroughly effective, as shown by 45 sections of the sympathetic nerve performed by the author in cases of vasomotor sequelae affecting fingers and hands.

Peri-humeral section of the sympathetic nerve mostly suffices, though serious cases of long standing may require perisubclavicular section, inferior cervical ramisection or stellate section.

5. To combat *painful phenomena* of the "ascending neuritis" type of causalgia, catenary operation of the sympathetic is preferable to posterior roof section or cord section, which should only be resorted to in quite exceptional cases in the surgical treatment of accidents to the hand.

6. Injections of novocain given in the beginning or immediately following the first suspicion of trophic and painful manifestations and continued as long as necessary may prevent the outbreak of symptoms liable to lead to definite invalidity in the case of victims of slight accidents of an essentially benignant type.

F. DIAGNOSIS FOR COMPENSATION ASSESSMENT. The author commences by referring to the fact that two principal considerations govern medical assessment of injuries of the upper limbs.

1. In the case of the upper limbs the fingers are everything; the handicap involved in amputation of the finger is almost equal in gravity to that of amputation of an arm. In the case of the lower limbs, on the contrary, the gravity increases progressively with the height of the amputation, and amputation of the toes is of slight importance.

2. In the case of the upper limbs prothesis may be said to be almost ineffective; it is without exception useless in industrial work, and the provision of artificial limbs or devices to replace these has never met with success of any account. In the case of the lower limb, on the other hand, even the most simple prothesis constitutes an essential element in the resumption of work. This difference is due to the fact that in the case of the upper limb it is mobility which counts, while in the case of a lower limb solidity is essential.

Mobility being the requisite quality of the fingers, fixed position of these, whatever it may be, either flexion or extension, is always disastrous

from the functional aspect, and it is very rare to see a worker utilizing continuously a stiffened finger.

AFTER these general considerations the author discusses the order of importance of the hands and of the fingers. He draws attention to the fact that the study of this question is less advanced than it would appear. Is left-handedness an advantage or a disadvantage? Is it total, or only limited to certain functions? What view must be taken of ambidexterousness? How does the muscular mass function in the case of a left-handed person? How is it possible to distinguish volume due to oedema and that which is the result of a variation between the muscular masses? Is it advisable to carry out comparative measurement of the muscles at rest and muscles in movement?

There is less difficulty in classifying the fingers, the thumb being obviously the most useful, on condition, however, that an opposite finger is retained.

It is also essential to remember that the thumb is not only a physiological but also a pathological entity; it stiffens less readily than the other fingers, which on the contrary are connected together in a physiological and pathological manner, the effect of this being often very troublesome.

The report concludes with a few considerations regarding the psychology of the injured. It is not only at Marseilles, the author stated, that Arab workmen are employed. Their mentality is similar whether they are Syrians, Tunisians, Algerians, or Moroccan subjects and is very near to simulation by which it is often accompanied. This often marks a racial tendency, a kind of abandonment of will-power, which spreads subsequent to the least physical injury, and which is favored by the almost complete absence of needs and a submission, without doubt wrongly interpreted, to the precepts of the Koran.

This slothful reaction to the consequences of an accident is also seen in Europeans, but with them it is both rarer and less serious.

IT IS necessary to insist on the *high incidence of these injuries* (30 to 50% of all industrial accidents), which, in 20 to 25% of the cases, involve definite infirmity.

This results in:

1. For insurance companies, considerable financial burdens (higher than those demanded by treatment and compensation for all fractures).

2. For the victims, a permanent handicap (prolonged loss of wages, and, in certain cases of permanent incapacity, diminution of the working capacity which may necessitate a change of occupation; insufficient compensation in the cases of high percentages of incapacity).

Consolidation is very often retarded on account of faults committed in initial treatment (absence of surgical cleansing or insufficient excision) which are responsible for the very frequent secondary infectious complications and retarded trophic or cicatricial complications (vicious scarring, atypical forms and conical stumps).

The author draws attention to the advantage to be gained from recognition at the moment of consolidation of certain lesions (painful stumps, causalgias, traumatic asteoporoses) which justify active treatment likely to result in perceptible reduction of the permanent partial incapacity.

Assessment of incapacities should not be made with reference to a fixed scale which does not take into consideration pathological elements varying in the case of different patients. Even when established by taking into consideration the occupation of the victim, there is often risk, in the case of such a scale, of an injustice, to the detriment of the victim, except where it is established on an unduly generous basis likely to lead to injustice from the employer's point of view. Full liberty should be left to the medical expert in fixing the invalidity rate in each particular individual case.

All assessment of incapacity should be established by starting from invalidity representing total loss of the hand (50 to 55% for the left hand, 65 to 66⅔% for the right hand). On the basis of these data, slight invalidity—by far the most frequent—is assessed at 5 to 15%, average invalidity at 15 to 30%, and serious cases at 30 to 60%. The author thereafter studies functional derangements of the hand and their assessment, finger injuries (amputations, ankyloses, complex lesions) and indicates average figures as to their assessment.

It should be stated that the study of invalidity rates reveals the very important fact that a stiff ankylosed finger with a faulty position is often more of a handicap than an amputated finger. Thus a policy of saving at all costs injured fingers may lead to the paradoxical situation of prolonging the treatment and retarding healing, and at the same time involving a higher incapacity percentage than in the case of an immediate amputation.

Revision. Retarded aggravation of cases is rare. Only certain painful affections must be taken into consideration, and demand revision with increase of compensation.

Attenuation of infirmity is, on the contrary, the rule, due either to healing of the injuries or to adaptation resulting from habit. It is only in cases where improvement is due to objective modification of scars that the allowance may be reduced. On the other hand, good adaptation, however perfect it may be, can never justify reduction of compensation.

It would certainly be unjust to penalize victims showing proof of intelligence and courage by making the best of their mutilation.

Conclusions. Three conclusions should be kept in mind:

1. *From the social standpoint,* measures of prevention are indicated with a view to reducing the number of accidents by improved occupational training of workers and by application of all protection devices of practical use in industry.

2. *From the medicolegal point of view,* assessment of injuries should be effected by specialized experts. Assessments should take into account the injuries produced by traumatism, the physical condition and the mentality of the victim, the particular conditions of his occupation—all matters which it is impossible to settle in advance by means of a scale, however detailed it may be.

3. *From a surgical point of view,* the treatment of injuries to the hand and fingers should be entrusted to qualified surgeons. Surgery in such cases is often very delicate, and at times very difficult.

To entrust it always to competent practitioners is the best means of diminishing the duration of

treatment, of avoiding complications and reducing the invalidity rates.

Industrial Dusts

DUST SAMPLING AND DUST COUNTING. The objects to be attained in the investigation of dust clouds in industry have been outlined and the function and limitations of the methods of determining the number of size-frequency of the particles have been indicated. The method should be sufficient for ascertaining the relative exposure of workers under various conditions in a particular industry, and for assessing the value of preventive measures.

A laboratory method has been described for testing the efficiency of instruments used for the estimation of dust clouds found in industry, and three instruments have been tested against a standard cloud of flint dust containing the range of particle-size met with in industrial clouds.

These instruments were the Greenburg-Smith Impinger, used according to standard U. S. practice; a circular Konimeter, used according to South African practice, and the Owens Jet dust-counter. The instruments have been briefly described, and the advantages and disadvantages of each have been summarized.

A new instrument is the thermal precipitator, also described. When tested by laboratory methods it was found to be practically 100% efficient for all particles likely to be of pathogenic importance. Samples can be taken over periods of time from a few minutes to two hours or more, and it is capable of dealing with wide ranges of concentration. It gives accurate information about numbers and size-frequency of particles.

Methods have been developed for removing by ignition, extraneous particles of atmospheric soot from the samples; for protecting the instrument from clogging by large particles, and for attaching the instrument to the chest of the workman. Size-frequency determinations carried out on dust clouds produced in the process of dressing sandstones showed little variation between clouds of widely different concentration: 80-90% of the particles were less than two microns in diameter, and 35-45% were less than .5 micron in diameter.

A brief description of investigations with the thermal precipitator in four industries has been included.

THE reporter is of the opinion that in practice, from the health point of view, it is of more importance to learn the *weight* and *chemical composition* of the various substances in suspension in the atmosphere in large industrial areas than to engage in research relative to dust counting in a given volume of air.

B. COMPARATIVE VALUE OF THE DIFFERENT MEANS OF COMBATING INDUSTRIAL DUSTS. The campaign against industrial dusts in the atmosphere is effected by removal of dust from industrial gases at the moment at which these are liberated.

This is done by applying active mechanical or physical force to the dust.

Apparatus for dust removal must fulfill a number of conditions and its efficiency must be readily evident.

There are three principal methods: the dry, the wet, and the electric method. The first comprises dust removal by the use of sacks, by gravity, by centrifugalization; the second comprises wet curtains utilizing a stream of oil or of water; and the third, or electric method, consists of dust removal by ionization.

The International Competition for Dust Removal (Liege, 1930) demonstrated the results to be attained with these three methods.

THE filtering properties of the nose are of great importance in protecting the body against dust.

As a result of investigations carried out in the laboratory and in the factory vast differences were found in the dust retention capacity of various filtering products.

No single filtering material was capable of retaining 100% of a dust without hindrance to the respiration. Hindance to respiration was found on examination to vary greatly. As might be expected it was discovered that greater retention capacity went hand in hand with increased hindrance to respiration for filtering surfaces of the same dimensions.

The limits of endurable hindrance to respiration may be calculated in different ways. Results of research into the presence of dust inside compressed air helmets during sand-blasting are conflicting.

IN THE construction of respiratory filters for fine dusts preference should be given to one-way respiration. Testing of dust filters should, in consequence, not be effected in a direct current but in an oscillating current.

A simple apparatus for production of dusty atmosphere of a fairly constant composition for respiration tests, with one-way respiration, is described.

Provisional tests of two insertion filters of different types, have shown that recent smoke and fog filters provide extensive protection against fine quartz dust, in so far as it may be admitted that no relation exists between the harmful influence of quartz dust of extremely fine subdivision and the weight of the aspirated dust.

Should it, however, be proved that the harmful effect, relatively independent of the weight of the dust, increases with diminution in the size of the particles, all research so far effected, as regards permeability of various filtering products, becomes almost valueless by reason of the fact that quantitative methods of determination are no longer practical for ultra- and a-microscopic dusts.

C. CRITERIA FOR SELECTING PRIOR TO THEIR ENGAGEMENT, PERSONS WHO WILL BE EXPOSED TO DANGEROUS DUSTS. The principal aim of industrial hygiene, legislation and factory management should be to organize industry on the basis of such technical and social measures that industrial work does not constitute a danger to the health of a normal individual with healthy constitution.

So long as this is not so, efforts must be made, by medical selection of workers, to exclude those showing *special* sensibility to certain sources of injury, for whom the work in question constitutes undoubted risk.

Unfortunately, knowledge of the nature of the "predisposition" to diseases and "sensitivity" to certain risks is very slender, and the means of detecting such predisposition are also inadequate.

Work involving exposure to *toxic* dust should

be prohibited for those presenting affections of the excretory passages, and for those liable on account of a previous illness to suffer more readily from the action of the poison, or to offer for that reason diminished constitutional resistance and hence be liable to more serious poisoning.

In the cases of diseases due to dust exerting an *allergic action* it is essential to exclude those showing hypersensitivity to the products in question; nevertheless present knowledge does not permit of recognition of the more or less marked tendency to develop hypersensitivity. Practical knowledge in this sphere is confined to the fact that individuals with a clear skin and red hair are specially sensitive to substances likely to affect the skin.

The development of silicosis depends to a large extent on individual predisposition. G. Lehmann appears to have shown the importance of the nose in this connection, by a comparison of the capacity of the nose for fixing dust with the degree of silicosis present. Practical control of these results, however, is required.

For the time being action must be limited to admitting, on the basis of radiographic control, those who are vigorous, with good chest development and sound lungs and heart, and eliminating all others. Periodical examination of those admitted is essential. Research should be effected by qualified doctors, with radiography of the thoracic organs.

THE criteria to be adopted by the medical man with regard to the admission or rejection of workers applying for work in dusty industries, are of a constitutional order, either anatomical or functional. These criteria are more particularly connected with the respiratory system, since pneumoconiosis is the most important occupational pathological manifestation of exposure to dust.

Guided by the principle that industrial dusts almost always exert their harmful effect on the system in conjunction with tubercular infection and that pneumoconiosis involves predisposition to pulmonary tuberculosis and *vice versa* from the anatomical and clinical as well as from the statistical aspect, the author, in seeking the terms in which the problem of admission of workers to dusty occupations should be stated and the problem solved, bases his discussion principally on the three conceptions: industrial dust, pneumoconiosis, pulmonary tuberculosis.

In admitting or rejecting candidates for the work in question, there must be taken into account, apart from general health conditions, the state of the respiratory organs in their entirety as well as in each of their separate parts. An estimate must be made of "individual constitution" (conformation of the nose, lips and thorax — for instance, development of tonsils) but quite special importance must be attached to general "individual constitution." The author has followed the Italian classification of organic constitution into three morphological groups: normal line types (average normal man); long line types (tubercular appearance); short line types (apoplectic), to which he has added two sub-types corresponding to arthritic and lymphatic diatheses. In regard to decision as to the admission or rejection of candidates for dusty industrial work, the reporter formulates the following conclusion:

Acceptance of normal line types; the rejection *en masse* of asthenic long line types with a tubercular appearance; acceptance of solid and muscular short line types; rejection of round, soft, flaccid short line types with a lymphatic appearance; the rejection of those suffering from adenoids and all those presenting even slight morbid phenomena or sequelae of diseases of the respiratory system.

As regards the majority of individuals designated as indefinite or mixed constitutional types and who do not lend themselves to classification, the reporter suggests taking into account each of the single characteristics or the special systems showing the state of the respiratory apparatus, both in its structure and functioning, rather than the general constitution in its entirety.

Finally, in addition to the individual anthropological factor, it is necessary to take into account the dust factor. Not such strict control is required with regard to occupations involving exposure to dust without effect on the human constitution (or almost without effect), such as flour dust, while restrictions as regards work in dangerous dusts, such as silica dust, must be applied with the maximum severity.

D. First Symptoms of an Intolerance of Dangerous Occupations. Work in dusty atmosphere, whatever the nature of the dust, is unhealthy. A normally constituted man can, nevertheless, stand bad conditions of this nature, without harm, for a certain time, which varies with the quantity and nature of the dust, the type of work done, the man's constitution, etc., the reason being that the lungs are protected against dust by two essential systems: first the naso-bronchial mechanism, which can retain and eliminate one-half or two-thirds of the dust contained in the air breathed; and second, the lymphatic mechanism, which rejects a very large part of the dust deposited in the lungs.

The efficiency of each of these protective systems depends on several factors.

The naso-bronchial mechanism varies in a pronounced way with the individual, and, less apparently, with the nature and form of the particles of dust. There is much uncertainty in regard thereto, and fuller study on points of detail is desirable.

On the other hand, the working of the mechanism for protection by lymphatic purification depends to a large extent both on the nature and properties of the dust and on the state of the epulmonary lymphatic system—that is to say, on anatomical conditions.

EXPERIENCE shows some dusts find their way out rapidly, and others less rapidly, to the ganglia. Without going into detail regarding the machinery which governs the efficiency of the lymphatic purification of the lungs, it may be pointed out that not only the chemical composition but also the size and shape of dust particles have a powerful influence; and it may well be asked whether the obvious significance of the chemical side has not recently led to some little neglect of the part played by the physical characteristics of the particles.

The state of the lymphatic system and the efficiency with which it functions in different individuals are probably in many cases responsible for differences in sensibility to dust. In identical conditions so far as dust is concerned, an individual whose pulmonary lymphatic passages rapidly

and efficiently eject the particles which enter the organ will be less likely to contract pneumoconiosis than one whose lungs retain the dust owing to the insufficiency of the lymphatic emunctory. The decisive factor in the origin of pneumoconiosis is not what enters the lung, but what remains there.

When the machinery for the elimination of dust in the lungs is not deranged, its efficiency is most remarkable. Thanks to processes of various sorts, an animal can by massive inhalation accumulate in its lungs extraordinary quantities of dust. If the animal is normal and its lungs function as they should, the whole of the dust is eliminated in a relatively short time. A typical experiment is the following: Rats are subjected to forced inhalation of air very heavily charged with metallic dust for some 10 hours (two hours a day). The animals used as controls which are killed immediately after the last inhalation are found to have a large majority of their alveoli full of dust; indeed it is hard to understand how they were able to continue breathing under such conditions. But if the remaining animals are killed at varying intervals after the inhalation of dust has ceased, it is found that in a week most of the dust has been eliminated; in a month only a little remains; and in two months the lungs have returned to their previous condition.

The capacity of the normal lung to rid itself of dust which has invaded it is indeed extraordinary.

On the other hand, if the machinery for elimination is deranged, a different position arises.

It may, therefore, be concluded that there are two means of preventing pneumoconiotic lesions from arising during work in a dust atmosphere. First of all, the performance of such work by persons whose lungs have not sufficient natural means of protection against dust must be absolutely prohibited. Secondly, any person whose lungs seem to have reached the limit set by their natural defences must be withdrawn from the dangerous work. The organization of rest periods by means of employment in rotation would appear to be a most useful prophylactic measure from a physiological point of view.

Such a system would have to be based on medical examinations at engagement and very thorough periodical medical examinations thereafter. In these examinations it would be the doctor's special, and, indeed, principal, duty to detect pulmonary tuberculosis; he would also have to watch for nasal weakness and any other factor favorable to pneumoconiosis.

No illusion should be entertained as to the difficulties involved by such a scheme, less so, however, from the medical than from the social aspect. A discussion on this point, which took place at the Johannesburg Conference of 1930, reveals how serious the question is. What will become of workers who thus lose their employment without compensation, for they have no injury and no functional disturbance? Most of them will remain unemployed. Many will desire to be kept on, and, indeed, many will be. The withdrawal from dangerous work of persons incapable of bearing it without risk to their health, however desirable, must be accompanied by the substitution of other employment for that from which they are excluded. The study of this problem lies beyond the present report, but mention of it could not be overlooked.

IT IS extremely difficult for the hospital practitioner to diagnose the first signs of pneumoconiosis; he is faced with the insufficiency of medical semiology; and he obtains, as is well known, most information from x-ray examination.

But x-ray diagnoses of affections of this sort are very far from certain, for identical radiographs can be produced by totally different conditions.

It is most difficult to make a differential diagnosis even in the early stages between pneumoconiosis and certain forms of tuberculosis. In order to discriminate, it is indispensable to know exactly in what conditions the patient worked—the geological, mineralogical, chemical and physical conditions, and the actual technique of the occupation. The patient's constitution and previous condition play a very important part.

Aside from the usual propaedeutic methods, and particularly x-ray examination, a two-fold anamnesis must be available, that of the occupation and the personal anamnesis of the patient himself.

Gases

NATURE OF THE GASES ESCAPING FROM FIERY SEAMS; DETECTION AND PREVENTION. In the first part of his report, the author reviews the various kinds of gases found in Belgian mines. He deals first with those found accidentally, and makes a summary reference to the essential factors relative to detection and prevention (sulphuretted hydrogen, carbon monoxide, carbon dioxide, etc.). The principal gas emitted however is that universally known under the name of firedamp (*schlagwetter grisou*) and it is this gas which forms the subject of the remainder of the report.

The composition of firedamp is studied in the light of numerous analyses made by low temperature methods (liquid air) at the National Institute of Mines. The samples of firedamp examined were taken from various Belgian mines and from all possible types of deposits (workings, exploration in virgin soil, gas jets, etc.). Methane is the principal constituent of firedamp (93% to 99%). One other saturated hydrocarbon (C_2H_6) is found in it is lesser quantity, 3%. Hydrogen never exceeds the exceptional figure of 6%, the average being 1.47%; carbon dioxide varies from 1% to 3%. As regards hydrogen, it exists, when present, in traces too slight to modify in any way whatsoever the characteristics of the gas. From the point of view of the campaign against firedamp, it is possible to consider it as composed of pure methane.

Chapter II deals with quantities of firedamp liberated by strata; describes the results of a long investigation carried out in Belgium with the collaboration of the Mines Administration. The output in firedamp in a mine varies much less than might be supposed in the course of the 24 hours of a single day. It does not cease when coal-getting stops. The quantities emitted are much greater in the province of Hainaut than in the Liege and Campine beds, and may amount to 150 cubic meters of firedamp per ton extracted daily, and, exceptionally, even more than this. Mines subject to instantaneous liberation of firedamp are more notable by reason of the irregularity of the emission of the gas than by its amount.

In Chapter III, dealing with detection, the author gives the procedure of immediate detection.

The simplest and the most generally utilized means is still the safety flame lamp, but it is essential to know how to use it. All useful indications in this regard are given in detail. Various other devices for immediate detection are referred to (the Leon-Montlucon firedamp meter; the Naylor Spiralarm, the Zeiss Interferometer, the Daloz apparatus, and the Mac Luckie apparatus).

Chapter IV deals with prevention, and, in recalling the properties of firedamp, emphasizes the fact that the only means of protection against danger is the provision of ventilation such that the gas emitted becomes immediately diluted in such proportion of pure air that there is never any formation of explosive mixture. It is essential, therefore, to provide ventilation subsequent to the emission of firedamp. To be in a position to do this involves measuring the firedamp and analyzing carefully the various ventilating currents as regards their methane content. There follows a critical account of the various apparatus used in the combustion method; the method of analysis based on the limit of inflammability is that which necessitates the least amount of apparatus, and also that which may be applied by any conscientious operator without requiring special chemical knowledge and which finally assures the greatest accuracy.

In conclusion, the author refers to research, so far fruitless, into the problem of substances to be added in small quantities to an atmosphere which contains firedamp with a view to attenuating or suppressing its inflammability.

NATURE OF GASES IN MINES. The analysis of a large number of samples of natural gas taken from various French coal mines proves that coal beds under ordinary conditions liberate a gas composed almost exclusively of methane, with the exception of certain deposits which give off carbonic acid, often in instantaneous outbursts.

Apart from these two gases, coal liberates the higher carbides merely in practically negligible quantities, though certain coals retain considerable quantities thereof which appear during grinding in vacuo—small quantities of helium, a little nitrogen accompanied by argon and other rare gases. Jets of nitrogen are, however, observed.

The potash and petrol mines of Alsace liberate the higher carbides in stronger proportions.

2. RATE OF LIBERATION. Firedamp comes either directly from cut or crushed coal or from drainage of further distant sections of the mass due to preparatory work and opening up of the working face, or to drainage of virgin deposits due to cracks behind the working face or to blowings out.

The proportions from these different sources vary greatly according to the nature of the deposit and the manner in which it is worked. The very definite relation between the pressure of the air and the liberation of the gas is to be ascribed to the change in the rate of liberation rather than to the influence of a vacuum in old workings.

Carbonic acid is in much closer connection with the coal-getting face than firedamp.

Fire often produces noxious gases, owing to the presence of carbon monoxide. The oxygen content of the atmosphere is reduced by the production of carbonic acid, and eventually by the continued liberation of hydrocarbides. Behind the barriers, this reduction of oxygen increases rapidly.

3. DETECTION AND PREVENTION. The safety flame lamp is the best means for recognizing the presence of firedamp or carbonic acid in dangerous quantities. The Leon firedamp meter permits an accurate estimation of the content of firedamp in the atmosphere. As regards laboratory analyses, the limit of inflammability method gives particularly steady results.

Eudiometric methods demand very accurate technique.

In an irrespirable atmosphere, breathing masks, as a protection against carbon monoxide, and the oxygen regeneration apparatus used in France give good results.

B. PHYSIOLOGICAL AND PATHOLOGICAL EFFECTS. 1. Firedamp is chiefly methane. Carbone dioxide is almost always present. Occasionally firedamp contains a small amount of ethane, propane, butane, and other gases.

2. Methane is physiologically inactive, except for the action due to the decreasing of oxygen in the air.

3. Ethane, propane and butane are physiologically inactive in the concentrations found in the firedamp in the mines of the United States.

4. The principal hazard due to the presence of methane is its explosibility when mixed with air in percentages of from 5½ to 13.

5. As a diluent of oxygen in the air, methane may indirectly produce the effects of oxygen want.

6. Carbon dioxide, while almost always present in firedamp, is not reported in high enough concentrations to be important from a physiological standpoint.

7. Other gases occasionally present in firedamp also do not occur in high enough concentrations to cause symptoms.

WHEN talking of gas in mines it is essential to have a clear idea of what is meant. "Mine atmosphere," properly so called, which the miner breathes must be distinguished from gases and firedamp suddenly liberated, and from explosive inflammable mixtures of gas. Gases met with during explosions and fires in coal mines are not dealt with in this report, nor is vitiation of the air in mines by men, animals, lighting, putrefaction and other sources of decomposition. The report is confined to volatile gas and compounds contained in the coal itself which are spontaneously liberated when the coal is cut, and particularly when it is broken up. It is a question of numerous products given off during chemical extraction by dissolvents, or by extraction of coals without application of heat. All volatile products of this kind are found in mines, though in very small quantities. As far as can be ascertained, there are found also, besides the well-known gases such as methane, ethane, propane, etc., less volatile neutral basic and acid constituents, compounds with or without oxygen, phenols and other hydropylated compounds and compounds of nitrogen and sulphur. In natural coal, not therefore in tar, there is found a mixture of partly isomeric hydrocarbons of the aliphatic, aromatic and hydrocyclic series, so far almost impossible to analyze. It is highly probable that a part of these compounds, in so far at least as they are volatile, passes into the air breathed by the miner. To that is added *carbonic acid* resulting from oxidation. Together with *methane* it forms the principal constituent of impurities in the atmosphere. Much careful research

has been effected on this problem, but up till now there has been a lack of systematic research in relation to other gases, especially the lower hydrocarbons, such as ethan, propane, etc. From the toxicological and hygienic aspect it is necessary to take into consideration, besides chemical conditions not so far thoroughly investigated, also *physical factors:* abnormal atmospheric pressure, damp, high temperature, frequent temperature variations, strong air currents, influence of radiations, etc.

Among the anti-physiological conditions of first importance are lack of oxygen in the air and the content of numerous strange gases. Until now little or nothing has been known of the *chronic action,* and especially of the consequences of continuous inspiration, over a period of years, of gases in themselves designated as *indifferent.* The same is true of methane and carbonic acid. The part played by carbon monoxide and sulphuretted hydrogen and other toxic gases and, further, also radioactive substances in gases given off by strata with a firedamp content, has not so far been made clear.

In view of the lack of certitude as regards the chemical bases, the connection between mine gas and miners' diseases can only be determined with the greatest caution. On the one hand the dominant fact is *lack of oxygen* in the pits and the presence of various gases belonging to the *narcotics of the methane series.* On the other hand, statistics reveal a whole series of effects on the health of miners.

But judgment in the matter is rendered difficult by an extraordinary accumulation of different causes to which must be added the anti-physiological conditions under which heavy work has to be accomplished. There is, nevertheless, no doubt that *toxic factors* play a part in the matter, and probably to *a much greater extent than has been so far assumed.* The lack of oxygen is in itself responsible for diminished resistance in general, and exerts in the long run an effect on the various systems. To this is added the varied effects of the gases in question: the influence of carbonic acid, considered as harmless, on respiration, circulation and metabolism must not be underestimated; breathing of this gas produces the same effect as physical work. Further, definite data are for the moment not available except in so far as concerns diseases of the *nervous system, the system with the greatest need of oxygen and the most sensitive to poisons.* In this field, among the multiform disorders encountered, the most important is miners' nystagmus. This difficult problem cannot be resolved without taking into consideration the part played by *toxicological factors,* and in no wise purely on the basis of simple ophthalmological examination. Apart from the well-known causes dealt with in the special literature on the subject and which point to the influence of the air in mines, emphasis must be laid on the fact that among the numerous poisons which have been shown experimentally to cause nystagmus, the *methane derivatives* — hydrocarbons, alcohol, narcotics, etc.—occupy the most important place. Carbon monoxide, lighting gas, benzene, petroleum, also belong to this class. Nystagmus should very probably be considered as a special type of occupational neurosis having as its cause disturbance of coordination. The simplest explanation of its origin is to be sought in toxic effect exerted on the nervous centers concerned. In the production of complicated disturbance of the reflex apparatus there may be traced the influence of various factors (optic conditions, fatigue, working conditions), the relative importance of which has yet to be determined. It is almost indisputable that the gases in question, perhaps even methane, cause, after exposure lasting for years, a toxic predisposition which favors the outbreak of nystagmus. The probability of this is still greater in regard to other gases, and more especially in regard to the effect of combinations, but absolute proof of this does not so far exist, and to obtain it implies very extensive, thorough and accurate research which could be best realized by collaboration between the various peoples having at heart the welfare of their workers.

PROTECTION against the noxious gases of industry is quite as important as against those of war. The principal classes of such gases are: (1) asphyxiants, (2) irritants, (3) volatile drugs and drug-like substances, and (4) inorganic and organometallic gases. The effects of these various types of gases differ widely, and their treatment should differ correspondingly.

Among all the noxious gases carbon monoxide kills the greatest number of victims. It is produced by the incomplete combustion of organic matter in mine fires and explosions, in the exhaust gas of automobiles, and in the smoke of burning buildings.

Even when present only in extremely small amounts it combines with the hemoglobin of the blood in the lungs and renders the blood incapable of carrying oxygen to the tissues. It thus induces asphyxia. Curves are shown indicating the rate of absorption of carbon monoxide from atmospheres containing various amounts of the gas, and a curve indicating the rate of elimination when the amount that has been absorbed is small.

Evidence both from experiments on animals and from observations on men has demonstrated that in profound asphyxia respiration is greatly depressed, and the rate of elimination is correspondingly slow. Oxygen diluted with carbon dioxide has been demonstrated to be the most effective stimulus to respiration. Accordingly a method of resuscitation by means of inhalation of oxygen and 7% carbon dioxide has been developed. This mixture is administered by means of inhalators, of which several thousand are now in use in American cities. A very large saving of life is thus effected. The cases thus treated include not only carbon monoxide asphyxia, but also electric shock, asphyxia of the new-born, and post-anesthetic collapse.

DR. HAUTAIN'S report (first part) provides data furnished by investigations effected among miners whose lives were spent in firedamp laden mines and who, nevertheless, had not suffered from spells of asphyxia, and also among miners of the same category who had suffered from asphyxia with loss of consciousness.

The report deals further with numerous medical examinations of these workers, and provides the conclusion that none of them was found to suffer from any anatomical changes or any physiological affections which could be ascribed to the action of small or large doses of methane.

The second part of the report deals with experi-

ments carried out in the laboratory of the National Institute of Mines at Paturages on animals subjected to progressive doses of methane mixed with the atmosphere, as compared with the reaction of such animals to an atmosphere of hydrogen or nitrogen. These experiments prove the effect of methane to be negative as long as the proportion of oxygen contained in the air does not fall below 5%. In an atmosphere containing 8% of oxygen and 37% of methane a dog shows no signs of asphyxiation or other symptoms. Autopsies (dogs, guinea pigs) following death caused by an atmosphere of high firedamp content (75%) revealed no anatomic lesion. Blood analyses with spectroscopic examination and anatomicopathological analyses were equally negative. The report concludes that cases of asphyxia are attributable entirely to the absence or extreme rarefaction of oxygen in the inspired air.

Pain

PATHOLOGICAL ALTERATIONS OF THE SENSE OF PAIN. All spontaneous pain being of necessity regarded as pathological, there may be distinguished three orders of facts in the study of subjective pain: — painful phenomena connected with a patholgical attack on *the viscera;*—painful phenomena connected with *an attack on the nervous system* affecting the paths of sensibility at one point;—painful phenomena dependent on psychic affections.

1. *Visceral algias* present physiopathological problems of the greatest general interest. A study of this is connected with the principle of the insensibility of the viscera to usual stimuli. Visceral pain only occurs as the effect of an adequate pathological stimulus. Propagated by the visceral sympathetic nerve, the pain is transmitted to the paths of cerebro-spinal sensibility. This union of the autonomous system and the nervous system leads to projection of pain at metametric points of the viscera, at the level of which may be noted a whole series of objective sensitive symptoms.

2. *Injuries to the nervous system affecting the paths of sensibility* are manifested by various painful syndromes which must be studied at different stages. There may be successively noted: peripheral painful sensitive syndromes, connected with peripheral nervous traumatic injury (interruption, compression, regeneration, neuritic irritation, etc.;—neuralgias of the trunk, of the plexus, of the ganglions and of the roots;—erythromelalgias and acroparesthesia;—pains from forms of polyneuritis; — painful medullar syndromes; — in injuries to the spinal marrow;—in medullary concussion;—in various medullary affections;—*painful encephalic syndromes;*—painful thalamic syndromes, sensitive cortical syndromes.

3. Among forms of *psychopathic* pain or psychalgias, hallucinatory pains, pains based on delirious interpretation, do not exist apart from the psychic derangement in which they originate. On the other hand, it is essential to proceed with the utmost reserve in regard to the real psychic nature of certain types of pain described, such as central algias and the algias of "neurasthenic" patients. It is impossible not to connect these with certain algias of a sympathetic nature, with which they have often certain features in common, even to a striking extent.

Analytical study of the various pain syndromes enables a synthetic view to be taken of these, which leads to classification of the different algias regarded on their physiopathological bases.

B. OBJECTIVE DIAGNOSIS OF PAIN IN INJURED PERSONS. When pain immediately accompanies an anatomic injury, objective diagnosis is often easy, and its importance is generally only secondary, since the damage which it causes is confused with loss of function.

At times pain forms a single or isolated consequence involving invalidity, or again it may constitute a more or less extensive contributing factor in the general invalidity so called. At this point it is important to recognize its existence and estimate its extent as accurately as possible; the medical expert in this case is obliged to resort to a number of means of control which are more or less indirect.

The author then presents a survey of the factors and signs at the disposal of the medical man in this connection; through clinical examination, detection of malingering, test for dilatation of the pupils, acceleration of the pulse, raised blood pressure, and to these he adds the specific sign to which he personally draws attention—fall of the pH in the urine.

He discusses the value of each of these tests and refers to a certain number of other painful reactions which are for the moment of limited utility (chronaxia, psychogalvanic reflex, the derangement of the secretions, adrenalinemia).

Electrical Injuries

PREVENTION. 1. Protection against danger from electricity ("electro-hygiene") is a question not only of individual protection, but also of *international safety regulation:* safety on electric railways, in navigation and aviation, etc.

2. Measures relative to *protection* from contact —more especially in connection with utilization of the so-called *lowest voltage currents,* of hand lamps and other electric apparatus—should be reconsidered and *revised.*

3. The question of deciding whether preference should be given to *direct current or alternating current* should be examined from the point of view of both personal protection and general safety.

4. It is not possible to arrive at a *general and comprehensive* decision in regard to the execution of *earthing* as a means of *protection*—as distinct from ordinary earthing forming part of the electric system.

5. Similarly, protection *from contact* (accidents), protection against *emissions* (occupational diseases due to rays, short waves, gas, dusts (storage batteries) *require reorganization* in conformity with recent views on the matter; and, last but not least, reform is needed in regard to protection of the rescuers in the case of extricating the victims from the electric current, and to means of controlling outbreaks of fire due to electricity.

6. The measures taken for prevention toward outbreaks, explosions and corrosions from electricity, may be improved in many important degrees.

7. *Existing statistics* in regard to accidents, fires, explosions and other material disasters due

to natural occurrences (lightning, frost, earthquakes, etc.) should be *reconstituted in the light of recent scientific criteria* in conformity with the results of research into electropathology and electrophysiography.

8. An *international center* should be created—the most ideal center is perhaps the International Labour Office with its periodical International Conferences—in view of the necessity for development of important problems of safety and the need for elucidation of these, and in view also of the necessity for influencing (by means of recommendations and possibly conventions and ratifications) *national legislation* in regard to this subject, standardization of safety regulations issued by electrotechnical associations and complementary decisions of insurance companies in regard to compensation for injury, uniform standards in regard to periodic control of electric plant in the transport industries, whether publicly or privately owned, systematic organization of inquiries, and where necessary, of legal awards in cases of accident and disaster due to electricity, and finally, creation of institutions for research and practical training in regard to protection against danger arising from electricity.

B. MORBID ANATOMY. 1. Electrical accidents are as a rule characterized from the anatomico-pathological aspect by local changes at the point of entry and exit of the current. In addition, in a certain number of cases, changes also occur in internal organs at some distance therefrom which have either been traversed by the current or influenced indirectly through the nervous or vascular system.

2. Local changes are very seldom lacking. Most frequently injuries of highly varied extent and type, ranging from a simple mark made by the current to serious burning, are found. The mark made by electric current is distinguishable from ordinary burning through certain biological peculiarities. Further, local or regional changes affect the striated muscles ("muscular spirals," hyaline bands, disintegration in clumps, necrosis) and the bones (schisis, necrosis, with dissolution of phosphate of lime), the blood vessels (necrosis, eventually thrombosis) and the nerves (disintegration in clumps of the myelin nerve sheaths).

3. Changes in the more distant organs may occur at different points:

(a) Muscular system: hyaline bands.

(b) Heart: dilatation; more usually the result of toxic action following burns and less frequently acute dilatation and hemorrhage of the myo- and endocardium, "muscular spirals." Electrical accidents when repeated are likely to leave, in consequence, changes of the cardiac muscle and sclerosis, as well as marked spasmophilia together with coronary sclerosis which may lead to angina pectoris and death through heart failure.

(c) Lungs: oedema is frequent, and likewise small hemorrhages.

(d) The blood in cases of pure electrocution is almost invariably liquid.

(e) There is fairly frequent ecchymosis of the mucous and serous membranes.

(f) The central nervous system often shows slight hemorrhages, sometimes oedema and various microscopic degenerative processes liable to lead to more morphological and functional disturbances.

4. Direct action of the electric current on the organs at the points of entry and exist is almost entirely due to the liberation of the Joule heat. Nevertheless certain changes, especially the "muscular spirals" of *Jellinek,* point to a special electro-mechanic influence.

5. Death by electrocution cannot be ascribed to a single cause. A certain number of fatal cases are due to extensive burning or to pure mechanical trauma (falls).

High tension currents much more rarely cause sudden death than low tension currents of 100 to 500 volts.

PATHOLOGICAL anatomical analysis of material from Switzerland reveals that in the case of death purely due to electrocution the cause is asphyxia with primary arrest of respiration and more rarely heart failure. Death through direct effect on the brain is of rare occurrence in electric accidents. It is still doubtful whether pre-existing heart affections play a part in death by electrocution, by reason of offering diminished resistance.

The status thymico-lymphaticus, on the other hand, plays a truly important part in death by electrocution.

C. ELECTRICAL INJURIES. The electric current passing through the human body exercises from the traumatic aspect firstly an electro-mechanic action, then an electro-chemical action, and finally a caloric action (Joule action).

"Electric trauma" are of two types: (a) the electric current may give rise to general phenomena (electric shock) which constitute general electrocution; (b) local injuries, "electric burns," which have a very specific appearance and which must not be confused with ordinary burns due to fire or to chemical agents.

The author describes the symptomatology of these general and local phenomena caused by electricity.

A special chapter is devoted to the immediate and retarded consequences which may affect survivors.

From the therapeutic point of view every electrocuted person should be treated like a victim of drowning (D'Arsonval).

As in the case of drowning, victims of electrocution may be very pallid or may be cyanosed. The basis of the immediate treatment is in both cases the application of artificial respiration, which must be pursued intensively throughout several hours.

To consider each case of electrocution as a state of apparent death is, according to Jellinek, the formula most fruitful in practical results.

The treatment of electrical burns must, above all, aim at saving the part affected. Immediate amputation of carbonized limbs is very rarely indicated.

Before recourse is had to surgical intervention, it is necessary, and practical, to temporize until natural healing indicates clearly the line of demarcation between the healthy and the carbonized tissue.

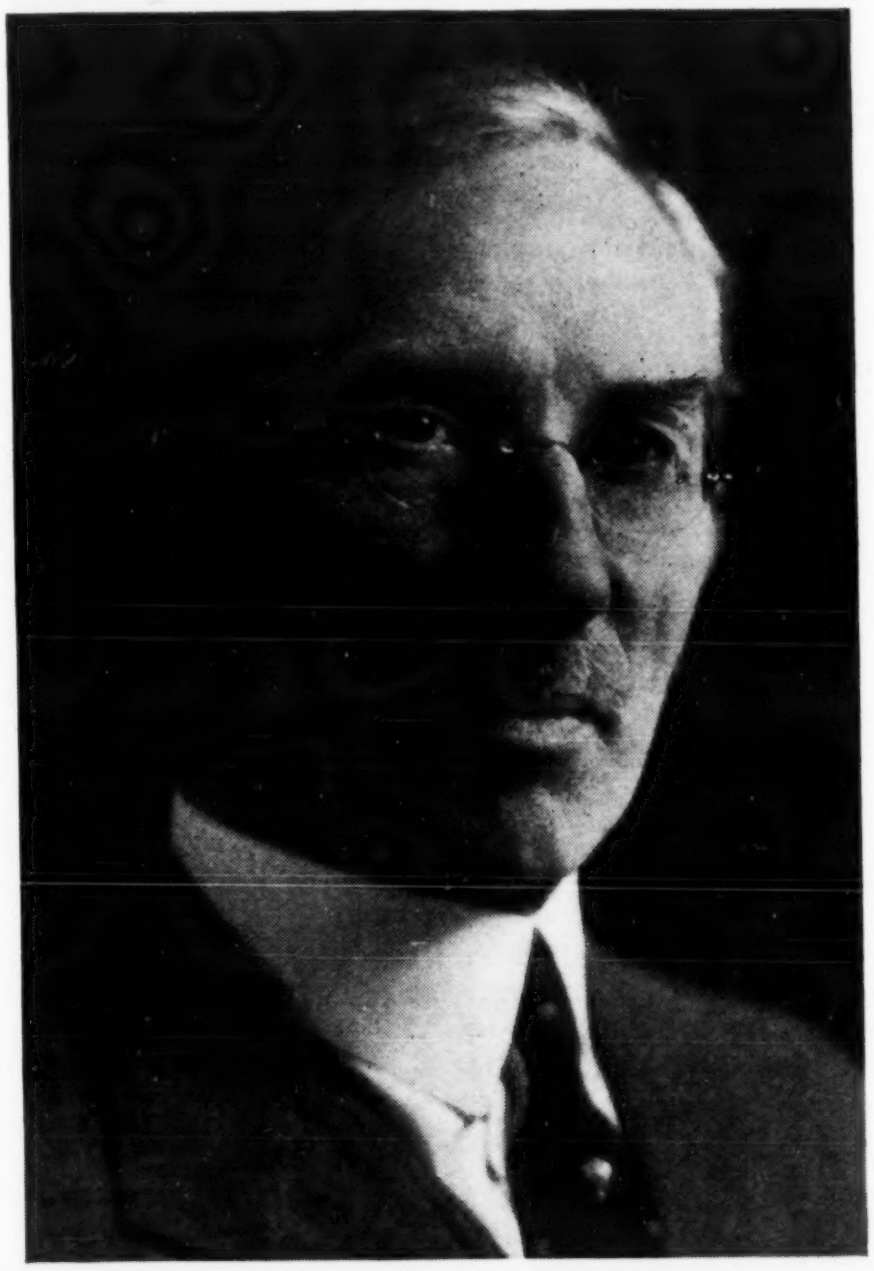
Limbs touched by electricity should not be immobilized but should, on the contrary, be exercised as early as possible with a view to preserving tonicity of the tissues undamaged by the current and inducing the greatest possible suppleness in the scarred tissue.

—C. O. SAPPINGTON, M.D., Dr.P.H.

Who's Who in I. M. & S.

—"*One of Those Quiet Men Who Carry a Heavy Burden and Do It Well*"—

ONE DAY, a little more than 30 years ago, Dr. Frank Billings, of beloved memory, handed his assistant a letter with the request that it be not mailed, but delivered. A week later, however, the letter was still in the assistant's pocket. Dr. Billings then changed his request to an order, and thereupon delivery was duly, if reluctantly, made. The result, as Dr. Billings intended, was that Thomas Reid Crowder, M.D., was properly introduced to Robert Todd Lincoln, Pullman Company president—and another of the careers importantly identified with the pioneer period of industrial medicine and surgery was started on its way.



THOMAS REID CROWDER

THOMAS REID CROWDER wanted to be an internist. It was in the blood; his father was a physician, his father's father was a physician. And it was in the atmosphere of his home, at Sullivan, Indiana, where he was born in February, 1872, and where one of his brothers was also making ready to carry on the family tradition. Returning home at 22, with his Ph.B. from De Pauw University, he prepared to enter Rush Medical, whence his father and his father's father had emerged M.D.'s and he and his brother were to do likewise.

He was graduated M.D. in 1897. Then followed an internship at Cook County Hospital, Chicago. Rush Medical elected him Fellow in Pathology in 1899, and he was instructor in medicine there from 1900 to 1903, and instructor in surgery in 1904. During this period he had a year at the University of Vienna, in genito-urinary diseases and pathology. As assistant to Dr. Frank Billings he had begun to vision the realization of his ambition. Then Destiny put her finger on him.

He did not go very willingly. He had fitted himself, with care and thoroughness, for the work he wanted to do. His interest and the quality of the application he gave to his studies are reflected in the fact that he stood at the top, or very close to it, in every one of the many examinations required of him. And the breadth of grasp and scientific exactness he brought to bear upon his chosen specialty are eloquently evident in his early writings.[1,2,3,4,5] One reading them recognizes his mastery of his subject and the excellence of his presentation, sensing at the same time such a repressed vitality of eagerness to be complete, and right, and thorough, as makes the reader want to exclaim: "This man loved his work." He did love his work, and he did not want to leave it.

But Destiny was aided by an infirmity—a disability of hearing, which made even auscultation difficult. And Robert Lincoln's problem needed just the kind of man he was. And one of the qualities that made Frank Billings great was a deep and fine understanding.

And so, in 1905, Thomas Reid Crowder, M.D., entered the Pullman service, in which he is, and for many years has been, Director of Sanitation and Surgery.

WHEN I began with the Pullman Company," says Dr. Crowder, "they gave me a little office and a great hell of a stack of papers." The latter proved to be communications from state authorities, their subject matter the innumerable rules and regulations with which the states in those days found it politically expedient to burden railway—and Pullman — operation. Every state had its own requirements; they attempted infinite detail; and no two were alike. Even a casual inspection showed the situation full of impossible inconsistencies. Not having been "a railroad man," Dr. Crowder wasn't familiar with the tradition of railroading that requires everything to be done by letter. So he pushed the "stack of papers" into wastebaskets, put on his hat and started off to see their writers.

This, as it turned out, was exactly the thing to do. A call here, a contact there, an acquaintance somewhere else—and soon he was liaison officer extraordinary between the Pullman Company and the health authorities of the nation and the separate states. But more than that, he began building, a little at a time, toward a uniformity of regulation which could ultimately find expression in a standard code.

A MAN whose work manifests exceptional ability will himself possess the concomitant adaptability. This, however, is the more difficult to use—which is probably one of the reasons why Destiny so often finds it wise to bear heavily down

upon reluctance to use it. But if there had been any lingering reluctance on Dr. Crowder's part to cut clear away from the career he had planned, it was not apparent in the quickly visible results from his new situation. On the contrary, only a short time had gone by before he was completely immersed in its medical and scientific, as well as its political, ramifications. These were interesting—extremely so.

The first problem of major importance was sanitation. In the light of our present habits of hygiene, exemplified in itinerant respects by the modern Pullman, some of the elements of that problem seem as much a part of the dark—and dirty—past as the community roller towel. The most obvious was the common drinking cup—renderer of lip disservice from time immemorial, but so much a popular institution that he said, in 1906, of a proposal to abolish its use: "It would be a sweeping reform, and the effect of such a move on the public humor can not be read in advance." Less obvious was "the liability of a passenger to acquire an infectious disease during his period of travel." And not at all obvious was the answer to the fact that "it is largely in the power of railway passengers to annul on the one hand the dangers incident to their own intermingling, and, on the other, whatever measures the railroad may take for their protection."

His first summary of these problems was read at the annual meeting of the American Public Health Association at Mexico City, in December, 1906[6]. Tucked away in its able and comprehensive text is this evidence of his own immediate accomplishments: "There has been applied to the Pullman service *within the past year* a system . . . which in my judgment meets the more important requirements for the maintenance of sanitary cars. Much labor is expended in removing dust; much time is given to sunning and airing; smoking rooms and closets, basins and cuspidors are washed daily with disinfectants; cars that have carried the sick are fumigated; all cars are fumigated monthly, and those running to health resorts weekly or oftener." (The italics, emphasizing the time element, are ours.)

IT WAS about then that the next major problem came to the necessity of being evaluated in scientific terms. Inventors had been suddenly prolific in applications of the injector principle to exhausting "dead air" from cars, and several types of ventilators were being tried. But there was no criterion of excellence by which to gauge their effectiveness.

Ventilation, therefore, became another subject of his characteristically intensive interest. He made his first report in 1911, after three years of study and experiment[7]—reaching the conclusion that "overheating is the paramount evil" in improper ventilation, and almost arriving at the stronger statements which he made, two years later, after three more reports,[8, 9, 10] that: "When trouble arises it is invariably connected with too much heat. When the temperature is low ventilation always seems to be good, regardless of the amount of respiratory contamination; when the temperature is high ventilation always seems to be bad, regardless of the chemical purity of the air . . . comfort and air purity have little or no relation, but comfort and air temperature and motion are very closely related . . . the air is bad or it is good, just as our sensations indicate; but it is bad or it is good in a physical and not in a chemical sense."[11]

These expressions seemed indicative of a line of thought that had intrigued him: possibly the ancient bug-a-boo of "respiratory contamination" had been over-rated; maybe there wasn't, in expired air, all the miasma tradition was accustomed to expect. Pursuit of this probability led to his 1913 monograph "On the Reinspiration of Expired Air."[12]

His ventilation studies, however, had shown the complete adequacy of the methods used in keeping car air healthfully fresh and clean. This study, therefore, was not scientifically necessary; there wasn't enough CO_2 in car air to make its presence any problem at all. But as a bit of pure research it was scientifically interesting. And it vastly aided the psychology of travel. For it was proof that there might be much more of CO_2 without its becoming any more of a problem; and before long it was recognized as proof, also, that a lot of the feeling of stuffiness in the sleeping berth is imaginary, and none of it symptomatic of CO_2 toxicity. And with this study behind him, he was sure of his ground when, in 1915, he wrote: "Perhaps the time has not yet come when we can say that fresh air is thoroughly understood. But we can certainly say with safety that popular conceptions concerning it are very erroneous. It is still commonly held that out-breathed air contains a volatile poison, and on this erroneous assumption have been developed the theories which have controlled the practice of ventilation almost up to the present time. There can of course be no doubt that the air confined in crowded places may become harmful through changes brought about by the people using it, and that it needs to be frequently renewed. The necessity for ventilation is beyond question; but the necessity does not arise from a poisoning of the air by the products of respiration . . . The success of ventilation depends far more on supplying conditions suited to the outside of the body than to the inside of the lungs."[13]

He didn't know that he was establishing principles which, 15 or 20 years later, were going to be adopted as basic by a new industry, nor that air-conditioning engineers were to quote extensively his expressions of them, without realizing that anyone was entitled to the "quotes."

IT WAS also in 1915 that he was called upon to put the company's employee medical service on a better basis—to organize a medical and surgical department, and thereafter to direct its work. What he did in this respect is probably best realized from the completeness and effectiveness of the Pullman medical service of the present time.

The scope of the yearly physical examinations he inaugurated includes a venereal disease survey. Pre-employment physical examinations are his invariable rule. Regarding these he is not sure that, by themselves, they afford much protection to an employer after the first three to five years of service, the incidence of the average disabilities being, by that time, about the same in a pre-examined group as in any similar number taken at random. He recognizes, however, that his situation is unusual in respect of both the labor turnover

which in other situations makes such examinations necessary, and the easy transition from a brief period of work to a long period of compensation which in so many situations is why they are necessary. In car service, where the majority of the employees—normally about 20,000—are engaged, the force is stable, the average age is high, and the turnover is low.

In the manufacturing operations every hazard is guarded, special occupational disease hazards by all the special preventive measures the hazards indicate. The lead men are examined at short intervals and watched all the time.

As to the silicosis hazard, he had one, too, in the manufacturing end of the company's activities. And there exists, in his manner of meeting it, a very important lesson to industrial executives. What he did is what any company doctor can do when he has company cooperation; and the fact that he did it is conclusive proof, as to the problems of occupational diseases in general—economic as well as medical—that the industrial physician and surgeon can take them in his stride when he is given the necessary executive backing.

In their new book, "Industrial Medicine," Clark and Drinker, after briefly describing some dusty incidents in manufacturing plants, make the remark: "Industrial physicians and engineers have seen these conditions but they cannot defend them." But what industrial physicians ever tried to defend them, or, on any basis, even wanted to try? They saw the conditions long ago, but they could not improve them. Medically they knew what to do; but recommendations have to wait upon boards of directors. As the "sand storm" of the recent silicosis "epidemic" blows over, it is becoming clearer that a great deal—if not most—of the executive agitation after it was too late for the doctors to head off the damage suits was directly the result of executive indifference while yet there was time for the doctors to prevent the damage. Ethical considerations permitting, a large number of industrial physicians and surgeons could tell of the long waiting periods wherein their hands were tied while company officials argued with the facts of silicosis, investigated the possibilities of a sericite alibi, and generally stalled along until they had to pay in judgments many times the amount that would have purchased effective prevention.

With the Pullman Company, however, silicosis was promptly recognized as a medical department problem. And Dr. Crowder met it squarely, effectively, and medically—not getting a bit excited about it, but simply taking it in his stride, as his executives took it for granted he would. And now, in Pullman manufacturing, no man is admitted to the "dusty" work—even though its dustiness has long been minimized—if he shows any evidence of lung pathology, and none is permitted to remain in it who develops any such evidence; the pre-employment examinations of those who are admitted are followed up by quarterly x-rays; the men are put on staggered service, three months on and three at something else; and every man on a "dusty" job is obliged to wear a positive-pressure mask.

With the dust hazard, as with every other occupational disease condition, Dr. Crowder's medical department is doing everything and all that medical science is sure ought to be done. And the same is true as to the numerous public health problems with which Pullman employees are in hourly contact.[22]

WE APPEAR to have left way behind the uniform sanitary code which, in 1905, Dr. Crowder began to dream about. But if we forgot it, he didn't. All the time he was occupied in tests and analyses, studies and plans he was quietly working toward it—although it must have seemed to him, once in a while at least, that with its evolution as formidable as any one of the labors of Hercules, the persuasion to its adoption would be more so than all the others. His paper on "The Sanitation of Railway Cars,"[14] in 1916, shows that the subject was never far from his thought.

The war and the United States Railroad Administration brought the opportunity to make his dream reality. The Committee on Health and Medical Relief, medically advisory to the Director General of Railroads, was organized; Drs. D. Z. Dunott, Chief Surgeon of the Western Maryland, and George Cale, Jr., Chief Surgeon of the Frisco, together with Dr. Crowder, represented the railroads, and the other two members were Dr. Victor G. Heiser, of the United States Public Health Service, and Dr. H. M. Bracken, of the Conference of State and Provincial Health Authorities of North America. These five men were given the task of drawing a single code from out of the innumerable and inconsistent laws of the various states. Their completed "Railway Sanitary Code" was published in 1920.[16]

When the Railroad Administration was dissolved, another committee was formed, at Dr. Crowder's suggestion, with representatives of the Conference of Health Authorities and the U. S. Public Health Service and himself as its members. The code was then "submitted to the Surgeon General of the U. S. Public Health Service and such changes were made as were necessary to bring it into accord with the Interstate Quarantine Regulations. Some amendments were also made by the Conference of State and Provincial Health Authorities."

Approved by the Conference, the code was then recommended to the states for adoption. In a year 18 of them had made it their own.[17] Today it is standard in 41 states; New York, New Jersey, Idaho, Rhode Island, Pennsylvania, Texas and Massachusetts are the only ones that have not given it formal approval; all of them, however, are giving it the sanction of daily use.[18]

With due acknowledgement of the assistance of his committee associates, and due credit to the help of all the others whose efforts gave him a "hand-up," this "Standard Railway Sanitary Code" is, nevertheless, Thomas Reid Crowder's work.

AN INDEPENDENT and original thinker, Dr. Crowder has his own ideas on some phases of industrial medicine and surgery. He well remembers the day when the "mine run of industrial medical work—and even industrial doctors—didn't amount to very much." There were, however, a number of capable and earnest men who had accepted industrial affiliations with the same idea that moved a philosophical gentleman of ancient Athens to say, when the people, thinking to

disgrace him, had elected him to a menial office: "Well, if the job doesn't reflect credit on me, I will reflect credit on it." These men gradually became known to each other, and before long they organized the American Association of Industrial Physicians and Surgeons. Dr. Crowder was one of the original governing board nearly 20 years ago. With all his professional memberships, he would admit that this organization interests him now quite as much as, if not more than, any other. But he doesn't always agree that it is living up to its objects and purposes. He thinks "the industrial men talk too much; do too little." He is afraid they "don't determine facts as fast as they draw conclusions." In some respects he would compare them to "the safety crowd, whose enthusiasm for the game outruns their knowledge of what they are doing."

His characterizations, on the rather rare occasions when he speaks of things that mean something to him, are eloquent, and, to say the least, colorful and picturesque. If he talks plainly, and sometimes critically, *of* his industrial medical contemporaries, he talks *to* them the same way. And he does both because they, and their interests, are close to his heart. He is keenly conscious that only a few of them have been favored with executive cooperation comparable to what has been given him; and so we suspect his criticism that they "talk too much" is only another way of suggesting that they talk less to each other and more to the presidents of their companies. And as for the younger men, and their enthusiasm, he hasn't forgotten that he himself, not very long ago, was as young, and eager, and enthusiastic as they are now; and behind the Tom Crowder who thinks independently and says what he thinks, regardless, is the Tom Crowder who is sensitively appreciative because of what Destiny has bestowed, and sensitively sympathetic because of what Tragedy has taken away.

DR. CROWDER is a Fellow, A.M.A., a member of the Chicago Medical and Illinois State Medical Societies, the Institute of Medicine of Chicago, the Society of Medical History of Chicago, the Chicago Pathological Society, the American Public Health and the National Tuberculosis Associations, the Associations of Railway Surgeons and Railway Chief Surgeons, and, last in listing here, but not subordinate to any in his affections, the American Association of Industrial Physicians and Surgeons.

He has his home in suburban Winnetka; three children, to whose interests he is devoted, leave him not too much time for his hobbies: books and a basement cabinet shop, or an occasional article for publication,[19, 20, 21] or possibly a backward look into the career in internal medicine so long since given over.[15]

His honors, like his years, sit lightly upon him; they are equally the eventualities of elapsed time constructively applied. He has been president of the American Association of Industrial Physicians and Surgeons; president of the Association of Railway Chief Surgeons; vice-president of the Institute of Medicine of Chicago; chairman of the Section on Industrial Hygiene of the American Public Health Association. He was a member of the Committee on Health and Medical Relief, during the period of Federal control of the railroads. And he is an Honorary Life Member of the Conference of State and Provincial Health Authorities of North America.

In any historical perspective upon industrial medicine, he is one of its pioneers—none the less so because he fared forth into new territory with full *safari* while others were setting out with only rifle and powder horn. The region of his work was as new as theirs; it was large, and sprawling, and unmapped; at its outer edges it merged from employee health into public health so definitely as to make him a sort of medical missionary for both. Physician, surgeon, sanitarian, scientist, engineer, public health officer, diplomat, liaison envoy, administrator—he has been all of these at times, until now he is all of them at once. His work as each has left (in his own words about something else), "a blazed trail in the wilderness of possibilities for good." His work, however, is by no means done; the problem of ventilation, for example, is "of lasting importance and is likely to recur"; air-conditioning is but one of the newer developments of transportation that are keeping him busy.

THE CREATOR, having made the universe, looked out upon it and "saw that it was good." Since, when he made man, he made him in his own image, man too can recognize the quality of what he does. Some token of "divinity within us," some vestige of original inheritance, lets us know when we, ourselves, have done good work.

And when we know, and are proud, why not? What else has man to be, with proper pride, proud of?

With proper pride: "As to what I have accomplished in the field of industrial medicine, that is not for me to say. I have some devoted friends who would probably tell you that it is a good deal, and some others, less or not at all devoted, who might say it is nil. Probably they are both equally wrong."

Dr. Crowder's "friends" are many — the fact speaking for itself. His acquaintances are legion —one of them, himself a pioneer in industrial surgery, says: "He is an important man. Everybody likes him."

But friends and acquaintances notwithstanding, one very impressive thing Dr. Crowder has done in industrial medicine and surgery, one of the many things of which he has every right to be proud, is this:

He has demonstrated, in unmistakable and permanent fashion, what an industrial physician and surgeon can accomplish when he has the kind of executive cooperation every industrial physician and surgeon ought to have but so few obtain.

Possibly he got that kind of cooperation because his personality and ability commanded it. Or possibly his executives were minded to give it to him. From the vantage point of the present writing, however, it seems that both were the fact; as to his ability and their willingness: he could; they would. At any rate, both *did*. And, in so doing, they set a mark:

The industrial medicine and surgery of the future — the "tall ship" of the poet's vision; Tom Crowder's record of medical, scientific, and economic accomplishment, for industrial medical men *and equally and alike for industrial executives*— "a star to steer her by."

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Concussion Injuries of the Eye

THE exact diagnosis of the character of the injury is often very difficult at first on account of the severe hemorrhage or edema, and therefore one should not be hurried in either treatment or prognosis. We would summarize our discussion with the following remarks:*

1. Every case of concussion injury should be carefully studied by all available methods.
2. A case history should be taken and should include such things as previous injury, or previous uveal tract inflammations. The glasses worn should be noted.
3. Relaxations of the zonule or dislocations of the lens may produce an acute myopia or other refractive changes.
4. A general physical examination, including blood cytology as well as blood chemistry, is imperative.
5. Transillumination should be utilized in every case to detect such findings as ruptures of the pigment epithelium.
6. Tension should be taken repeatedly, not only in the injured eye, but also of the uninjured eye, for a hypotony may not only indicate changes in the anterior segment, but likewise such conditions as rupture of the choroid, which might also give lowered tension.
7. The projection and perception of light, as well as the field of vision, should be taken repeatedly. Where there is much hemorrhage, this may be done with two illuminated objects, one for fixation, the other for the test object. This may determine a possible detachment, and so forth.
8. The depth of the anterior chamber is important to observe, for irregular depth may mean lens dislocations, rupture of the ligamentum pectinatum and ciliary muscle, etc.
9. A word of caution is not out of order as to the use of mydriatics in these cases. When injury is only a few hours old, and a mydriatic is indicated, we never begin with atropine. We always start with euphthalmine and adrenalin, then possibly a diluted homatropine, and use atropine last.
10. A guarded prognosis in concussion injuries should always be given, for the final outcome in these cases is undeterminable. This is of paramount importance from a medicolegal standpoint.

The more we see of eye traumas, and the more careful and detailed the study, using all available methods, including slit lamp microscopy, transillumination, and tonometry, the more convinced we are that there is no such thing as a minor eye injury. Only too often after an accident which at first seems to be trivial, with excellent prognostic outlook, the patient returns in a few months with marked organic changes.

* *Texas State J. Med.*, January, 1935.

Lead Poisoning

MYERSON* collected 19 cases of paralysis of the muscles of the larynx due to lead poisoning, to which he adds a personally observed case. A consideration of the various paralyses of the larynx due to lead poisoning leads him to question the validity of Semon's law, "that the fibers of the motor nerves going to the abductors succumb to organic affections sooner than or exclusively of the adductors." Semon believed that there was an actual biologic difference in the composition of the laryngeal muscles and nerve endings which explained the predilection of organic disease for the abductor muscles and their nerves. In the 20 cases of involvement of the larynx due to lead poisoning, there were two of unilateral abductor paralysis and no other involvement. There was one cases of unilateral abductor paralysis associated with involvement of the interarytenoideus muscle. A single case of paralysis of the interarytenoideus muscle is included, as are also two cases of bilateral adductor paralysis. An unusual case of involvement of both cricothyroid muscles is also included, so that seven of the 20 cases showed involvement of muscles other than the abductors. These seven cases constitute a definite challenge to the validity of Semon's law.

Ohio Occupational Diseases

REPORT of the Bureau of Occupational Diseases, lately made to the Director of Health, Dr. H. G. Southard, by Dr. E. R. Hayhurst, consultant in occupational diseases and acting bureau chief, shows that 626 Ohio physicians reported more cases in 1934—a total of 1556—than in any other year since the reporting law became operative. The previous high point was in 1929 with 1382 cases. Comparison also is made with 1258 cases in 1933. Thus notable increases are seen, the causes for which have not been investigated, but are probably various. The increase was not due to the addition of any new disease to the list of compensable diseases, as none was added by the last legislature. The report also shows that 290, or 18.6%, of the 1556 cases occurred among *females.*

* *Arch. Otolaryng.*, 20:615-764, November, 1934; abstr. *J.A.M.A.*, January 12, 1935.

In the past seven years, a total of 9,142 occupational diseases were reported by approximately 2,500 different physicians, among the employees of approximately 3,350 different employers.

In 1934, *dermatitis,* with 913 cases, constituted 58.7% of the total. Of these, 194, or 21.2%, were *females.* Tenosynovitis was second with 228 cases, lead poisoning third, with 162.

The leading causes of *dermatitis* were oils and cutting compounds, 131; alkalies and cleaners, 83; petroleum products, 49; paints, etc., 48; rubber, 45; bakelite, 44; plants and woods, 44; lime and cement, 42; dyes and dyed goods, 40.

The leading causes of the 162 cases of *lead poisoning* (and lead absorption) were: storage batteries 85, paints, dry colors, and painting 26, lead manufacture and recovery seven, caskets and vaults six, sanitary ware six, pottery five, others 27. Three of the lead cases were *females*—one engaged at filing, one as a brass assembler, and one as a solderer. In the six years (1928-1933 inclusive), 59 *deaths* were associated with lead poisoning (figures for 1934 are not yet at hand).

Interest centers chiefly around the *non-compensable cases,* which are subdivided into (1) those in which the cause or agent was stated, and (2) those in which only the disease or affliction, such as bronchitis, was stated. There were 104 in the agent group and 37 in the affliction group for 1934, or a total of 141 noncompensable cases. Among the *agents,* dust was the factor in 54 cases, classified as silicosis 42, silico-anthracosis five, silicatosis one, others six. This year no cases of asbestosis were reported. In addition, the following *afflictions* have a smacking of dust exposure: asthma two, bronchitis two, and tuberculosis 14.

During the seven-year period, 609 *non-compensable* cases were reported, of which 402 were "agent" cases, and 207 were afflictions. Of the 609 cases, 182 were definitely specified as due to inhaling dust, while 11 were asthma, 47 bronchitis, 64 pulmonary tuberculosis (allegedly industrial), and eight upper respiratory irritations. Space does not permit listing the numerous other causes of occupational diseases (chiefly poisons) which are not now on the compensation schedule, but undulant fever (seven cases among dairymen, abbatoir workers, etc.) and tularemia (six cases in rabbit handlers, etc.) are among those listed.

As regards the dust cases in the last few years, many have had their x-ray chest films sent to the department for evaluation and very complete records are had upon them. As a rule, they represent a totally and permanently disabled group. Most of them have been reported by the various state tuberculosis sanatoriums.

Of the 1,556 occupational diseases reported in 1934, 327 occurred chiefly through inhaling the substance, 933 by way of the skin, 228 through strain, 27 through friction, and 41 through other and non-specified means.

Acute mishaps, even though due to poisons, sudden strains, etc., are not included in any of the figures.

Of the 8,769 *physicians* registered in Ohio in 1934, 626, or 7.1%, sent in 1422 of the reports, (the remainder being reports by two or more physicians, or physicians residing outside of Ohio, incomplete reports, etc.). The leader was a plant physician who reported 108 cases; the second highest, a company of industrial physicians who reported 59 cases; and the third, another plant physician, who reported 48 cases. But it can be seen at a glance that private physicians, reporting one or two cases per year, made up the vast majority.

From the date of the receipt of the first report, May 15, 1913, a total of 17,443 occupational diseases was reported to the end of 1934.

Of these, 2,575 were reported in the eight years prior to the time compensation for occupational diseases began (Aug. 4, 1921), or an average of 322 cases a year. Since compensation began, 14,771 have been reported, or a yearly average of 1100 cases.

Expert Medical Testimony

Report of Special Committee

INTERVIEWS and conferences have been held with Superior Court Judges, attorneys, physicians and the Secretary of the Judicial Council of the Washington Bar Association.* Each individual had some opinion of his own on the subject. The only constructive work to date has been that of the Judicial Council of the Bar Association. Some months ago this Council sent a questionnaire to all members of the Washington Bar Association, one item of which was a recommendation that the State Supreme Court designate certain rules of Superior Court procedure governing expert medical testimony. More than 600 replies were received, about equally divided for and against the recommendation.

California has a law specifically governing expert medical witnesses.

The medical profession alone cannot accomplish anything which contemplates changing rules of court procedure or introducing new legislation in a matter so vital to the legal profession. Many of the criticisms against members of the medical profession justly come within the scope of medical ethics. In this regard the medical society can make rules and regulations governing its members.

The Bar Association has the subject of expert medical testimony before it for study and action. It seems most desirable that the medical society should cooperate and have representation in the development of a law or procedure which is of concern to the best interests of the profession.

In view of the foregoing, the following recommendations are submitted:

1. That the President of Washington State Medical Association shall address a communication to the Judicial Council of Washington State Bar Association offering the cooperation of the medical profession and soliciting consultation with designated representatives of the medical profession.

2. That the President shall appoint a special committee of three to be known as the Expert Medical Testimony Committee, whose duties shall be as follows:

(a) To represent the medical profession in its relation with the Judicial Council of the Bar Association.

(b) To draw up rules and regulations governing the conduct of members of the medical society appearing as expert medical witnesses.

(c) To provide ways and means of investigation, procedure and penalties, same submitted to the Board of Trustees of the Association for its action.

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* *Northwest Medicine,* November, 1934.

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Interpretation

ONE of the most potent factors in the production of difficulties in the occupational disease situation is the lack of qualified interpreters. An interpreter understands both languages—in the case of occupational disease, understands what constitutes an occupational disease hazard in the industrial environment, how it is measured, how to identify injurious conditions, what conditions are dangerous, and, on the other hand, the effects that such conditions can have upon the human body in the production of disease and disability.

Too often in the assessment of an occupational disease potentiality, reliance has been vested either in an engineer who is thoroughly capable of estimating and measuring industrial conditions, or in a physician who may be quite qualified in the diagnosis of occupational diseases. The fallacy lies in the lack of integration and coordination of the industrial exposure data with the medical findings, and the studying of the problem in terms of cause and effect. Thus the need for a real interpreter—the physician industrial hygienist.

We quote Glenn Frank; he has stated significantly the real issues of this problem: "The future of America is in the hands of two men—the investigator and the interpreter. We shall never lack for the administrator, the third man needed to complete this trinity of social servants. And we have an ample supply of investigators, but there is a shortage of readable and responsible interpreters, men who can effectively play mediator between the specialist and the layman. The practical value of every social invention or material discovery depends upon its being adequately interpreted to the masses. Science owes its effective ministry as much to the interpretive mind as to the creative mind. The knowledge of mankind is advanced by the investigator, but the investigator is not always the best interpreter of his discoveries. Rarely, in fact, do the genius for exploration and the genius for exposition meet in the same mind. Many negro mammies of the south can make a strawberry shortcake that would tempt the appetite of the gods, but they might cut sorry figures as domestic science lecturers. The interpreter stands between the layman, whose knowledge of all things is indefinite, and the investigator whose knowledge of one thing is authoritative. The investigator advances knowledge. The interpreter advances progress. History affords abundant evidence that civilization has advanced in direct ratio to the efficiency with which the thought of the thinkers has been translated into the language of the workers. Democracy of politics depends upon democracy of thought. 'When the interval between intellectual classes and the practical classes is too great,' says Buckle, 'the former will possess no influence, the latter will reap no benefit.' A dozen fields of thought are today congested with knowledge that the physical and social sciences have unearthed, and the whole tone and temper of American life can be lifted by putting this knowledge into general circulation. But where are the interpreters with the training and the willingness to think their way through this knowledge and translate it into the language of the streets?"

Too often are we prone to be led astray by the glamour of so-called research; too often are we attracted by the so-called brilliancy of the results of experimental and research endeavor. Such knowledge, however, is only useful after it is put into practice—this might seem obvious, but it certainly has not been recognized in the problems concerning occupational disease.

Many times it has been stated that if we were to put into actual practice our present knowledge concerning occupational disease, its prevention and control, as well as methods of taking care of occupational disease when it does occur, the present conditions might be greatly improved. This does not mean that research should be suspended—it must go on. But progress, as Frank says, is measured definitely by the application of research principles to the everyday problem in industry.

The occupational disease interpreter must be on speaking terms with research as conducted in that field; he must also know the practical problems of industry and medicine; he must further be able to apply the research principles to the practical problems, with the result that conditions can be improved. This is real progress.

Page upon page has been written and spoken about the practical versus the theoretical. In this sense, many persons believe that nothing but concrete examples of practical experiences are valuable. While it is true that practical experience is a great aid, one must go further and reason from practical experiences by the application of new ideas and reach conclusions which may be stated in the abstract. This is one of the forms of higher reasoning, and as such requires much discrimination, judgment and experience.

The problem of occupational diseases will continue to create puzzling and astonishing situations, until more well qualified interpreters are developed—men who are able to understand industrial and medical problems and who are further able, through critical and searching analysis, to state the solution in simple terms to manufacturers, employees, insurance groups, and attorneys.

Industrial Medicine and Surgery

Is There an Answer to the Silicosis Problem?

FEAR born of incomplete knowledge," says an insurance editor,* "is the heart of the silicosis problem." He continues:

"Workmen's compensation insurance has been a headache to casualty company executives for the past few years. For the time, at least, the pressure has been lifted by the rise in industrial activity with its accompanying increase in payrolls and premiums. Despite the fact that this field is emerging from a major crisis, apparently in good shape, the future, to many, looks pretty dark. The reason in two words is 'Occupational Disease' and in one—'Silicosis.' A real problem is presented—is there an answer? In considering the silicosis problem, too often those affected have given way to semi-hysterical speculation on the possibility of disaster. Of course, the proper approach to an answer is to ascertain the known facts and from them consider the probabilities. The best program to bring about the least damaging of the probable developments can then be worked out, and an intelligent effort made to avert serious trouble. Let us first consider the picture as painted in its darkest tones by a partly informed and very worried insurance executive. He has been advised that 25% of all the industrial workers of the United States have silicosis in some degree. He has been told that silicosis is progressive, that there is no cure, and that death or permanent disability is inevitable. He sees, in many states, determined efforts to put silicosis under workmen's compensation, efforts that were successful, at the last session of the legislatures in New York and North Carolina. From past experience with the industrial commissions and other agencies administering the various compensation laws, he has no confidence in their ability to distinguish between a workman disabled because of silicosis and a workman who, after exposure to silicia dust, has x-ray indications of that exposure but no disability. Appalled by the possible accumulated liability, with the firm conviction that an effort to avoid all risks with a dust hazard will result inevitably in state compensation funds, he stands bewildered, waiting for the fast approaching storm to sweep away the compensation business. The final outcome may be as bad as, or worse than, is feared. If it is, the blame will be placed squarely on the shoulders of the industrialists and insurance men. Consider briefly the facts known about silicosis, as set forth by the best known authorities. It is a disease of the lungs caused by the inhalation of large quantities of silica dust over long periods of time. In its early stages it is not disabling, and even in advanced cases disability or death is almost invariably due to some other infection of the lung, usually tuberculosis. A person with silicosis has less resistance to a tubercular infection than another with normal lungs, and an inactive tubercular infection may become reactivated by exposure to silica dust. Industry must remove tuberculars from occupations exposed to dust, and will probably have to pay them compensation. The incidence of tuberculosis among those exposed to dust, outside of miners where other factors are largely responsible, is not alarmingly high. Modern engineering can reduce the dust hazard in any industry to the point where the occupation is perfectly safe for any worker whose lungs are free from infection when he begins work. Persons working under dusty conditions for years, who have developed some silicosis but not any infection, will probably never become disabled from this cause if the necessary protective measures are taken where they work. There is no medical evidence that silicosis causes the impairment of any other organ, such as the heart. The reserve lung capacity is so great that the lung can continue to function even though great masses of fibrous tissue have been formed as a result of silicosis.

WITH this in mind, take the hypothetical case of a foundry with 600 employees. Of these, 300 have been exposed to concentrations of dust varying from light in the case of furnace tenders to very heavy in the sand-blast room. On medical and x-ray examinations, it is found that almost 200 have some evidence of silicosis, with perhaps a dozen advanced cases uncomplicated by infection. Six have tuberculosis as well as silicosis. The risk is obviously dynamite, but the size of the explosion depends on how the situation is handled. The dust hazard in the plant must be cleaned up; to do this the cooperation of the employer is necessary. Then the employer will be expected to explain the exact state of affairs to the tubercular employees, and send them to a sanitorium, with compensation paid their families or dependents. Further, the men with advanced cases of silicosis will expect to be given light work within their capacity and kept on the payroll. The others can be left undisturbed, except that they should be required to take yearly physical examination; and all new employees will first undergo a complete examination. Such a program costs money, but if followed it will result in not only cleaning up a bad situation, but also in guarding against future trouble, and it is believed will in the end be less costly to the employer. On the other hand, if, after the results of the medical examination are known, the carrier gets off of the risk and does nothing, and the tubercular men are discharged, as well as those with advanced silicosis and some of the others, it is more than likely that the employer will be faced with suits which will turn the liability back on him and his carrier. At the same time, the employer will find it impossible to get insurance from another company and he will join in the chorus of those shouting for a state fund. The big problem in silicosis is education. Manufacturers must be convinced that the hazard exists and that it must be eliminated. The medical profession, now woefully at sea, must learn how to diagnose silicosis and to determine the extent of disability, if any exists. Industrial boards and commissions must study the disease, its causes and effects, so that they will be in a position to make an intelligent decision on the medical evidence. The insurance companies must learn how to attack a risk which has a silicosis hazard so that it may be made insurable, and how to handle it when it is insured. The refusal to write any risks with a dust hazard and the cancellation of any now insured will not solve the problem and will probably destroy the compensation business.

*Editorial in *Journal of American Insurance*, July, 1935.

Prevention of Occupational Diseases

AFTER September 1, 1935, "any and all occupational diseases" are subject to compensation.* In view of this fact general preventive measures should be considered with renewed interest. The extension of the scope of the workmen's compensation law is based on the fact that many poisonous substances are used in industry that should be controlled, and it is to the benefit of the individual as well as of the state that health should be maintained during the course of work.

Although there are many kinds of dust, gases and fumes in industry, and greatly varying conditions of temperature and humidity, their control is based on comparatively few principles. The worker will work better and live longer in pure air than if it is filled with dust, gases or fumes. The problem, then, is one of ventilation, the object of which is to dilute the poison so that it will become harmless. Fresh air may be pumped into the working space to dilute whatever poisons exist or the poison may be sucked out, in which case it is replaced by pure air which gradually seeps in. The most effective method is that whereby the dust, gases or fumes are abstracted at the point of origin. Care should therefore be taken to attain this objective.

Experiments have shown that the suction apparatus is only 15% efficient when removed but six inches from the point of origin in the case of the hand pneumatic tool. This fact is of tremendous significance in the layout, design and use of exhaust ventilation apparatus. Ample exhaust must be provided unless the suction orifice can be placed at the point where the dust is generated. Some employers provide adequate systems for the removal of deleterious

The Industrial Bulletin, August, 1935.

DEPENDABLE PROTECTION

The Quality Line

Against Dusts in Industry

It's the hidden quality that produces the fine results accomplished by Willson Dustite Respirators in industrial dust disease prevention. Two respirators may resemble each other in exterior quality as closely as "peas in a pod," and yet one of them may approach the ideal respirator providing protection, comfort, face seal, low breathing resistance over a period of use, no interference with vision, no rebreathing exhaled air, economy and other features. This respirator is suitable for the most hazardous job, and the other which provides only one or two of these features might be good for only the least hazardous job, or none at all. In every Willson respirator goes the practical and scientific knowledge that has required years of time and thousands of dollars to acquire. We are always glad to cooperate with the industrial physician in the preparation of recommendations for unsafe conditions.

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IDEAL FRACTURE TREATMENT for INDUSTRIAL SURGEONS

Böhler---TREATMENT OF FRACTURES

By DR. LORENZ BOHLER, Director of the Hospital for Accidents, Vienna; Lecturer on Surgery, University of Vienna. Translation from the fourth enlarged and revised German edition by Ernest W. Hey Groves, M.S., F.R.C.S., Emeritus Professor of Surgery, University of Bristol. Buckram binding, gold stamped, 6½ x 10¼, 588 pages, 1059 illustrations, $12.00.

LORENZ BOHLER has long been internationally famous for his many successful developments in methods for the treatment of all kinds of fractures. The German editions of his book are well known in America, but their use has naturally been restricted by the limitations of language. Even a fair reading knowledge of German is not sufficient for a complete grasp of principles or a reliable understanding of details of technique. Many American surgeons have wished for a complete and reliable English translation of Dr. Bohler's work, and one is now ready. Not only a complete translation of the fourth German edition, but added material, not previously published, from Dr. Bohler's latest experience with Fractures of the Spine, and of the Neck of the Femur. Not a dull machine-like translation by an uncomprehending literary hack, but a work of appreciation done by a man who is himself a well known master-surgeon. Ernest Hey Groves, editor of the British Journal of Surgery, an authority on fractures who deliberately postponed revision of his own excellent book on the treatment of fractures in order to pay tribute to the Viennese master of the art, and make his work better available to all English-speaking surgeons. It has been well said that Dr. Bohler's book reveals he has that quality of genius which consists in the infinite capacity for taking pains. **All of** his painstakingly acquired knowledge and experience is now available to every American orthopedist and general surgeon.

Bohler's methods are not experiments but a carefully compiled and developed system, superior to that commonly in use, covering many years experience with a large number of cases. Many American practitioners have visited his hospital where thirty to forty visiting surgeons from all countries watch his work daily. In fact the Bohler experience and methods have been for several years increasingly used in many American cities with success and satisfaction. In the words of a well-known California surgeon, "These methods, applied in the treatment of injuries result in a lessened disability period, an earlier return to the proper industrial status of the patient, a shortened period of hospitalization, and the least possible impairment of function. The morale and physical well being of the injured are enhanced and economy to society ensues."

No surgeon should rest content until he has a copy of Bohler on his bookshelf for reference, for comparative purposes to aid him in improving his own methods and technique. The book is a liberal education in fracture treatment.

WILLIAM WOOD & CO. (Division of the Williams & Wilkins Co.) Baltimore

fumes but fail to see that they are used properly. The cost is exactly the same whether the apparatus is used ineffectively or not. Foremen should always instruct workers in the proper use of ventilation systems. In addition, the employer should see that all ventilation equipment is kept in a proper condition. Pipes gradually clog up or leak and fans wear out unless they are inspected periodically and repaired.

Removal of dust at the point of origin is not always possible, as in the case of sand-blasting. The alternative is to provide the worker with a helmet and a positive pressure of fresh air while he is engaged in working. The sand-blasting room should be air-tight, otherwise the fine particles will spread into the workrooms.

The State Department of Labor, to enable employers to reach more hygienic standards, has created the Division of Industrial Hygiene for the purpose of solving problems relating to ventilation. But, this is only one of its activities. It also has a staff of physicians, safety engineers, chemists and inspectors whose sole purpose is the prevention of accidents and occupational diseases. All employers of New York State are entitled to use their experience freely.

Sometimes it is possible to substitute one substance for another found to be disagreeable or dangerous. An example of this is shown in the foundry industry where, in the last few years, a non-silica bearing material has been substituted for one having a high silica content. But, it is seldom that an employer asks himself whether a material he is going to use is good or bad for health. He switches from one thing to another not knowing what the danger is, if any. He assumes that because the material is commonly used, it is safe.

Considerable improvement in the health of workers may be obtained by substituting petroleum naphtha for a more poisonous ingredient. For instance, petroleum naphtha now takes the place of benzol in many cases where the latter was at one time believed to be essential. The importance of this change was due to the fact that benzol poisons the blood while the substitute does not. Unfortunately, before this change had been made, it was thought that toluol and xylol were a satisfactory substitute for benzol. The employers using them reasoned that no cases of poisoning were on record regarding their use. It was soon found out, however, that these substances, chemically similar to benzol, were poisonous in much the same way.

It is impossible to substitute one material for another successfully without understanding their chemical composition and effects. The question is often difficult as to the relative risk of one substance in comparison with another. Some manufacturers discarded petroleum naphtha, a slight fire hazard, and began to use carbon tetrachloride, a liquid which will not burn. The latter substance, however, has a disagreeable smell, and many think it dangerous to health. However, the smell always gives warning of its presence and, besides, the fumes are not dangerous unless breathed in considerable quantities. The manufacturers of the apparatus in which carbon tetrachloride is used have enclosed their machinery as completely as possible. This tends to conserve the liquid and prevents workers from breathing the fumes.

Another phase of prevention is the avoidance of contact by handling. One way is the use of mechanical methods of manipulation or conveyance. Another is the use of gloves, respirators and aprons in handling. The adoption of mechanical handling, a purely managerial problem, results in reduced contact with deleterious substances, and men are also saved the fatigue that comes from carrying heavy loads. Gloves, respirators and aprons reduce contact with poisonous substances. Gloves should be impervious, if used with liquids, otherwise they may do more harm than good. Rubber gloves should be properly made and of sufficient thickness for electrical use. In some cases the accelerator used in the manufacture of gloves is apt to cause a rash when the hands perspire. The use of respirators is advised only as a last resort and when the deleterious dust cannot be removed at its source. In the early part of 1935 the U. S. Bureau of Mines adopted the plan of testing and approving certain types of respirators, particularly for use as regards silica dust. When one considers that it is only the extremely small particles of silica dust that are harmful, it will be understood that the task of the respirator is one of considerable difficulty and that, in general, abstraction of the dust at the point of origin is a much better solution of the problem.

Another method of reducing contact is by ordinary hygienic methods,

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of which two may be considered. First, there is the problem of keeping the factory workrooms clean. The habit of sweeping the shop while men are at work, especially where lead or silica dust is found, is undesirable and should be avoided. A much better plan is to use a vacuum cleaner at night after all workers have left. If dust cannot be removed in this way, wetting down the floor as in the case of foundries, may be adopted, but it should be recollected by all who have such a problem that moisture does not generally engage the extremely fine particles of silica that are in foundry dust. Respirators require continual attention when in use. They should be changed frequently, cleaned periodically and, in the larger industries, should be under the control of one individual who is responsible for getting and keeping them in condition.

The use of soap and water is too often neglected. Irritating dust when promptly removed will probably do no damage, but unless the hands are washed at least at the end of the day's work, local irritation may be set and poisoning may result. While it is always desirable to keep the exposed parts of the body clean, it is essential as regards the use of lead. Therefore lead workers should wash frequently, and the use of showers is recommended.

Neuritis from Industrial Poisons

ISENSCHMID and Kunz report the history of a man, aged 56, whose occupation caused him to inhale trichlorethylene.* He developed a severe retrobulbar neuritis with pupillary disturbances, paralysis of the hypoglossal nerve of the left side and polyneuritis of the nerves of all the extremities, with abolishment of the reflexes and reduction of the cutaneous sensitivity in the region of several peripheral nerves. The symptoms proved to be rather persistent and the vision seems to be permanently impaired. The authors call attention to the wide use of neurotoxic trichlorethylene, pointing out that it is employed as a fat solvent in industry as well as in cleaning fluids and other preparations marketed for home use.

Silicosis in Cast Iron Foundry

I HAVE been doing the insurance work for a cast iron foundry for several years and would appreciate any information that you might give me regarding the danger of silicosis in men engaged in cleaning and polishing castings. After the castings are made they are put in a revolving machine, called a rattler, to shake the excess sand and loose iron from the surface. They are then polished on emery wheels. How much danger is there of silicosis developing in men who have done this work for years, and what would be the best way of keeping down this dust? Would early silicosis show on x-ray plates?—M.D., Virginia.

Answer—There is no reason why men engaged in cleaning castings and in tending machinery used for this purpose should be subjected to silicosis-producing dusts in harmful concentrations. Prevention of dust inhalation is an accomplished fact in many well conducted foundries, and improper conditions can be corrected by wholly practical devices (McConnell, W. J., and Fehnel, J. W.: J. Indust. Hyg. 16:227 (July) 1934. McCord, C. P.: Pamphlet published in 1932 by the National Founders Association, Chicago).

Cleansing sand from castings by sand blasting or shot blasting is a recognized silicosis hazard entirely avoidable with modern equipment. Chipping off burrs and irregularities from sandy castings is likewise a practice that may cause silicosis and is readily avoidable.

The polishing of sand-free castings on emery wheels is standard foundry practice. The wheels gradually wear down, so that some finely divided abrasive and some iron dusts are thrown into the air. Neither of these dusts alone has been shown to cause silicosis. Information from the Norton Company, Worcester, Mass., is available on the design of dust exhausts for use with artificial abrasive wheels of all types. Such exhausts improve the working conditions.

Undoubtedly there is a silicosis hazard in the foundry that is conducted carelessly. At present the only method available for diagnosing early silicosis is by x-rays, and the foundry industry, like any other industry with a possible silicosis risk, should require periodic roentgen examinations of men with suspected dust exposure (Gardner, L. U.: The Pathologic Reaction in Various Pneumoconioses, The Journal, Aug. 19, 1933, p. 594. Pancoast, H. K., and Pendergrass, E. P.: Roentgen Technic with Especial Reference to Examination to Diagnose or Exclude Silicosis, J. Indust. Hyg. 16:165 (May) 1934).

*Dangers from Modern Industrial Poisons: Polyneuritis with Retrobulbar Neuritis After Working with Trichlorethylene. R. ISENSCHMID and E. KUNZ, *Schweiz. med. Wchnschr.*, Basel, June 8, 1935; Abstr. *J.A.M.A.*, July 27, 1935.

THE BULLETIN

of

The American Association of Industrial Physicians and Surgeons

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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Effects of Breathing Dusts with Special Reference to Silicosis

—Review of the Literature—

By D. Harrington
Chief, Health and Safety Branch, U. S. Bureau of Mines,
and
Sara J. Davenport
Principal Translator, U. S. Bureau of Mines

INDUSTRIAL MEDICINE for July, 1935, contained part of Section 1 of "U. S. Bureau of Mines Information Circular 6840"; the August issue had the remainder of Section 1; and this issue carries Section 2—"Determination of Dust in Air," as follows:

THE recognition of inhaled dust as the main factor in the production of pulmonary disease among miners drew attention to the quantitative aspects of the problem and the importance, as regards health, of determining the amount, weight, and particle-size frequency of the dust in air breathed by workers in various industries—especially those known as "dusty." Determination of dust also is becoming increasingly significant economically as evidence of the extent of the dust hazard involved in various dusty processes and as a measure of the efficiency of protective devices introduced to mitigate the hazard.

Determination of the dust content of the air by any of the more generally used methods entails the two processes of sampling and measuring the quantity of dust in the sample. Mavrogordato[63] classed the methods according to the nature of the sampling process—whether by precipitation (the konimetric or optical method) or by filtration (the sugar-tube or gravimetric method). Green[64] refers to two main types of methods used for sampling dusts: (1) methods by which bulk samples of the dust are extracted from the air for weighing and chemical analysis, for example, the sugar-tube method; and (2) methods by which dusts are collected in a state suitable for microscopic examination, for example, the konimeter. After the sample has been collected the particles are counted, and/or the mass is weighed[64].

The ideal instrument[74] must be capable of efficiently sampling the dusty atmosphere with particular reference to particles ranging from .5 micron to 10 microns, and it should be possible, once this sample is obtained, to count the number of such small particles present; from the hygienic viewpoint the count is the best index of the extent of atmospheric pollution. Determination of the weight of the dust would also be valuable; but because it is virtually impossible to separate the particles under 10 microns in size from those over 10 microns and thus obtain the weight of the injurious particles (those capable of gaining access to lung tissue) and because one large particle may weigh many hundreds of times more than a smaller one, the weight of a given sample of dust should be used only as an additional guide in the interpretation of results, and then with some degree of caution.

The range in dust concentration over which determinations might be required is very great. Some atmospheres (those prevailing outdoors after rainstorms) contain very small quantities of dust, whereas the air of mines or abrasive factories often is highly polluted; therefore, the instrument must be capable of sampling both high and low dust concentrations with equal efficiency—an exacting requirement, as it means that the dust-collecting medium (whether water, sugar, or an adhesive) must not add greatly to the dust of the sampled air. The "control" or "blank" of the instrument must be low, and it must be uniform in dust content; in other words, a sample of the collecting medium must be so uniform that the analysis of a representative sample gives a true picture of the dust content of all of it used in a given series of tests.

As the dust concentration of air is changing continually, the instrument must be capable of sampling large quantities of air to obtain a true picture of the condition. Once the sample has been obtained, the analysis should be as simple and rapid as possible; the more time-consuming and complex the method of analysis the lower its value. In many mines of the United States no electric power is available, and an instrument used for mine-dust sampling must be hand-driven; the instrument must be light in weight and portable and of a size to permit introduction into a working place without interfering with the workers' movements.

To summarize, the final choice of an instrument for sampling dust depends on its efficiency, its small errors in analysis, its portability and weight, and on the difficulty or ease with which the samples obtained may be analyzed. The instrument or method should also be able to eliminate, as far as possible, variations or errors due to the "human equation"—a difficult requirement.

Dust-Sampling Methods

IN GENERAL, dust-sampling methods can be grouped according to the physical principle utilized by the sampling instrument. This cannot be

an exact classification because some instruments involve the use of more than one physical principle. The chief methods used for sampling aerial dust are: Condensation, filtration, washing, sedimentation, electrostatic, resistance, and impinging. Greenburg[74] gives the following historical summary of the various methods.

Condensation: In 1875 Coulier[65] showed that dust in air could be made visible by reducing the pressure within the containing vessel, causing the moisture in the air of the vessel to condense on the dust particles. He further showed that condensation might be prevented by filtration of the air through a layer of cotton wool. This principle has since been utilized by various investigators.

Aitken koniscope: The Aitken koniscope, described by John Aitken in 1889,[66] consists of a metal tube and suction pump placed at right angles and joined by a connecting post. The metal tube, lined with hygroscopic material, is provided with a window at each end and a stopcock at the end distal to the point at which the pump is attached. In operation the tube is held horizontally and the pump vertically, the observer looking through the window in the tube at the point of attachment with the pump. Air is drawn into the apparatus by means of the pump, and the stopcock is then closed. The air, more or less saturated with moisture from the hygroscopic material in the tube, is rarefied by depressing the pump once again. The dew point is thus lowered, with the formation of a fog or cloud due to condensation of the moisture on the dust present. The density of the cloud or fog is then compared with suitable standards and a qualitative estimate of the air dustiness established.

Aitken dust counter: An improvement on the koniscope was devised by Aitken[66]; this essentially makes use of the same principle as the koniscope, but an attempt is made to count the number of particles in the air. In its earlier form the instrument was large and non-portable. It consisted of a receiver, an air pump, an air-measuring device, an illuminometer, and a gasometer. The air was drawn into the receiver by the gasometer. As it entered the receiver it was measured and mixed with a known quantity of dust-free air, saturated with water, and then rarefied by the pump. The rain, produced by condensation of water on the dust present, fell on the ruled, polished silver plate that formed the bottom of the receiver. The number of droplets on the counting plate multiplied by the proper factors for the amount of air sampled and the dilution with dust-free air gave a count of the number of particles present in the original sample. In addition to the disadvantage of being very large and non-portable manipulation is rather intricate and liable to large experimental and personal error.

Modified form of Aitken dust counter: The modified Aitken dust counter, devised to overcome some of the drawbacks of the earlier instrument, consists of a hollow box with a ruled glass bottom and a plain glass top and is supported on two cylinders which open into it[67]. One of the cylinders forms an air pump and contains the piston; the other cylinder is provided with three taps (stopcocks), the bores of which are of known volume. A plug of cotton wool is placed in the cylinder below the three taps, and the lower end of the cylinder is perforated so that air may enter. A mirror is supported beneath the receiver, and above it is a magnifying lens. Strips of damp blotting paper within the receiver saturate the air with moisture. By drawing down the piston when the stopcocks communicate with the cotton-wool chamber filtered air is drawn into the receiver. One of the taps (depending on the dustiness of the air to be sampled) is then turned at right angles to communicate with the outside air; it is then turned back again and the piston drawn down, bringing the sample of dusty air properly diluted with dust-free air into the receiver, where the dust is precipitated with the moisture in droplets on the ruled glass plate and the drops counted. Multiplication of the count by appropriate factors, as the volume of air sampled, gives a final figure for the number of particles of dust present in the original sample. This instrument is portable, being arranged on a tripod for field use. It has the disadvantage that the amount of air sampled is very small, and the opportunities for personal and experimental error are many. The most serious drawback is that all particles of dust receive equal significance, irrespective of size, since this method takes account of particles of ultramicroscopic size.

Hill diffractoscope: The Hill diffractoscope[68] is essentially the same as the Aitken koniscope. The results are only qualitative, giving a rough estimate of the dust present by observation of the intensity of a beam of light directed into the window of the rarefied air chamber (Tyndall effect).

Jet dust-counting apparatus: An adaptation of the principle of condensation is utilized in Owens' device[69], which he describes as follows:

"A high-velocity jet of air is caused to strike a microscope cover glass; the effect of this high velocity is to bring about a fall of pressure in the jet, accompanying which, and resulting from it, is a corresponding fall of temperature. This in turn causes a condensation of the moisture in the air upon the dust particles, which are thus projected wet against the cover glass, and, as the water evaporates, are left behind adhering to the glass."

In this apparatus the air is moistened by being passed through a chamber lined with moist blotting paper and is then drawn at high velocity through a slot about 1 cm. long and .1 mm. wide. After passing through this slot the air loses heat, and the moisture present condenses on the dust particles left on the microscope coverslip, forming the top of the cells. The coverslip is then placed under the microscope, and the particles are counted.

In his summary of the value from the viewpoint of industrial hygiene of the instruments designed to utilize the principle of condensation of moisture on dust particles Greenburg[74] states that those which permit a qualitative estimate only of the quantity of dust present have little practical value; those which permit the particles to be counted give results of limited significance because of errors in sampling and analysis and because of the difficulty of interpreting the counts, owing to the grouping of particles of ultramicroscopic size (which do not so far as is known constitute a health hazard) with those of a significant size from the hygienic viewpoint. The Owens apparatus yields high counts in normal indoor air; in very dusty atmosphere, however, the ribbon of dust on the microscope coverslip is so dense that counting the particles, even at high magnification, is difficult and often impossible.

Fehnel[70] mentions the following objections to the Owens jet dust counter:

1. The volume of sample, to be a fair, representative average, should be taken over a period of time because, except in a very few instances, the generation of dust is an intermittent process and is not constant.
2. The ribbon in the Owens jet counter sample does not have definite boundaries, and therefore counting the particles in a representative average band or integral part of the whole ribbon is very difficult.
3. The rate and efficiency of sampling with the Owens jet dust counter depend upon how rapidly the operator actuates the plunger. Also the washers are troublesome, and it is difficult to maintain the piston free of leakage.
4. It has been demonstrated that the Owens instrument is selective, sampling only particles of six microns and under.

Filtration: The principle of filtration has been applied to dust sampling in such various forms that only a few of these methods[74] need to be mentioned. In general, the air is filtered through cotton wool, cloth, paper, or a soluble chemical compound and the analysis made either by comparison with qualitative standards, by weighing, by counting the dust particles, and in some cases by both weighing and counting the dust.

Cotton-wool method: This method has been used by Arens, Cohen, Harcourt, Duckering, Cohen and Ruston, and Ditman[74]. It yields only the weight of the dust in the air, and although it is a very valuable method for the estimation of toxic dusts (lead or arsenic) it is of limited value in determining the potentiality of a dust as a producer of pneumoconiosis.

Cloth method: This involves the principle of filtration but utilizes cloth instead of cotton wool. Stacy used cheesecloth squares, which were weighed before and after the dust was sampled; the difference was considered the weight of the dust caught. Hill[71] used weighed cloth filter bags placed in a conical metal holder and connected to an anemometer for measuring the volume of air sampled. The difference in weight before and after sampling was considered to represent the amount of dust in the quantity of air filtered. This method was cumbersome and inaccurate and required too much time for a single determination. An apparatus similar in principle is known as the American automatic

dust filter[72]; the air is filtered through a series of four or more specially woven cloth bags in a closed cabinet. The difference in the weight of bags before and after passage of the air is taken as the weight of the dust in the volume of air passed through the instrument. The deficiencies of this instrument are similar to those of the Hill bag method previously described. The Carrier dry-filter apparatus[73] attempts to keep the filter bags dry during the sampling period by heating the air with an electric heating unit before it passes into the filtration bag. Because of the high temperature involved Todd[75] utilized disks of Canton flannel, held in a special device. The air was filtered through the cloth, which retained the dust; the disk then was compared with a series of standard disks ranging from 1° to 10° of a rather arbitrary scale. With some of these methods it is possible to graduate or classify roughly various atmospheres in groups based on the amount of dust present; but even then Greenburg says[74] serious error from the hygienic standpoint is involved, for an atmosphere of many small particles (small enough to gain access to the lung tissue and hence injurious) may give a lower scale reading than an atmosphere containing a smaller number of particles of relatively less hygienic significance.

The Gooch crucible[74] has been used with some success; this apparatus usually is an ordinary porcelain or platinum Gooch crucible, the bottom of which is covered with a mat of shredded, acid-treated asbestos. The crucible is dried and weighed carefully, placed in a suitable holding device, and a known quantity of air drawn over it, after which it is again dried and weighed. The difference in weight is taken to represent the weight of the dust in the quantity of air sampled. The filtration surface is small, and if the mat is thick enough to retain the greater portion of the dust the resistance to air flow is very high, and therefore only a small quantity of air can be sampled.

Filter paper: To overcome the objections to cloth filters and the Gooch crucible recourse has been had to filter paper for sampling dust. One of the earliest methods for the determination of dust by a filtration process was that of Rubner[74]; a holder in which was placed a piece of filter paper was connected by suitable tubing to a water-jet pump. The volume of air drawn through the paper was measured by a gas meter in series with the pump and paper holder. The dust was estimated by comparing the filter paper with a standard scale. Filter paper has been used by Sargent[76], Moller[77], Hubendick[78], Johannsen[79], and Nesbitt[80]. This method was used in Great Britain in studies conducted by the Advisory Committee on Atmospheric Pollution in 1916-17. An automatic apparatus was built by which three or four samples were taken each hour.

Paper thimbles: Filter-paper thimbles have been used successfully in a number of dust investigations[74]. The apparatus consists of a filter-paper thimble (similar to a Soxhlet thimble) and its holding device, by which the air is drawn through the thimble, and a meter for measuring the air. The thimble is dried in an oven and weighed before and after filtration, the difference in weight being taken as the amount of dust in the air sampled. Various grades of filter paper may range in efficiency from 63 to 90% when tested optically, using tobacco smoke as the test dust. The chief drawback from the hygienic viewpoint is that particles cannot be counted by the use of filter paper or filter-paper thimbles. Moreover, the utmost caution must be exercised in drying and handling the filter paper to avoid absorption of moisture and resulting errors in weighing. In an effort to overcome these objections many workers have used another type of filtration method in which the air is filtered through a soluble chemical compound. After being sampled the substance is dissolved, and the amount of dust is determined both by weight and by count or by comparison with a scale of standards.

By Hahn's method[81] air is drawn through a filter of collodion wool and the quantity measured by piston displacement. After a suitable amount of air has been sampled the collodion is dissolved in ether, and the solution is then compared with a series of arbitrary standards.

The most successful method of this type, one utilizing granulated sugar to filter dust, was first employed by Frankland[82] and later by various others, including the Miners' Phthisis Prevention Committee of South Africa[83], Higgins, Lanza, Laney, and Rice[84], and Fieldner, Katz, and Longfellow[85]. This method employs a sampling tube, in which a weighed amount (100 grams in the later types) of clear granulated sugar is placed. The dusty air is drawn through the tube by a pump or other suitable device. After a sufficient quantity of air has been sampled (usually 15 cubic feet) the sugar tube is taken to the laboratory for analysis. The sugar is dissolved in hot water, and count and weight determinations are made on the dust present.

Fieldner and his co-workers[85] found the efficiency of the sugar tube to be approximately 35% when it was tested optically with tobacco smoke and about 87% when tested gravimetrically with silica dust. These results would indicate relatively high filtering efficiency. Both weight and count of the number of insoluble and noncombustible dust particles present in a given atmosphere are obtained by this method. It has the disadvantage that a large and variable quantity of dust is present originally in all samples of sugar; it therefore cannot be used effectively for sampling either soluble or inflammable (combustible) dust.

Washing: Washing methods have been applied to the sampling of insoluble dust with much success[74]. These methods, in general, bubble the dust-laden air through water to the dust and bring it into suspension. The amount of dust present may be estimated by weight and count.

Palmer dust apparatus: This apparatus was devised in 1916[86]. It is a pear shaped glass bulb, at the base of which is a water trap so arranged that the air is drawn through the trap (preferably at a rate of 4 or 5 c. f. m.) and breaks the water into spray which washes the dust from the air. After a suitable quantity of air has been sampled, depending on its dustiness, the water is drained from the trap and taken to the laboratory for analysis. By this method both weight and count determinations may be made of some kinds of dust.

Variations of the washing methods have been devised by Meyer[87], Read[], and Drinker[88]. The main difficulty with washing methods, according to Greenburg[74], lies in the inability to wet very small particles of dust in the brief interval requisite to sampling large volumes of air. One obvious advantage of this method over the sugar-tube method is that the water used, if properly distilled, contains little or no dust, while the sugar in the sugar-tube method, no matter how carefully prepared, always contains a large and variable quantity of solids.

Sedimentation: In 1879 Miquel[89] described a method of collecting dust by allowing it to settle on plates. The particles were counted under a microscope. In 1880 Tissandier[90] substituted sheets of paper two meters square for the glass of Miquel. The paper was supported horizontally, and after a suitable time the dust was collected by a small brush and examined under the microscope. In 1902 Irwin[91] estimated the dust in Manchester air by collecting a volume of snow 100 square inches in area and one inch in depth. The snow was melted and filtered and the residue dried and weighed. Liefman[92] utilized two oil-coated disks on a revolving vertical shaft, one supported horizontally and the other vertically. A vane keeps the vertical disk facing the wind; this disk collects some dust by impaction, while the horizontal disk collects the dust deposited by sedimentation. The dust laden oil is removed from the plates by ether, and after evaporation the dust is again suspended in 5 cc. of oil. The final suspension is compared with a series of standards made by mixing various quantities of soot and oil. This method allows only a rough quantitative estimate of the dust present in the atmosphere.

Des Voeuz and Owens[93], used an enameled iron vessel two square feet in area arranged somewhat like a large funnel. The dust was washed down into a bottle beneath the funnel by rain. The Advisory Committee on Atmospheric Pollution of the Meteorological Office of Great Britain also used this method. Hill[71] used porcelain evaporating dishes; Mitchell[94], rectangular glass plates coated with vaseline and placed on poles 25 or 30 feet above the street level; and Whipple[95], two-quart tin pails coated inside and out with resistant varnish and suspended on poles about 20 feet above the street level. This method does not sample the air but permits an estimate of the quantity of dust that settles on the surface of the water.

Gravity settling methods, in general, do not indicate just how much dust a given sample of air contains but aid in estimating the amount of dust falling on and adhering to a given surface, either oiled, wetted, or dry, in a given period.

Green[97] describes accurate sedimentation methods for determining the number and size-frequency of particles in dust clouds. The con-

taining vessel for the sedimentation cell is a brass cylinder 5 cm. deep, and 3.6 cm. in diameter; it can be closed at the top by a swivel lid and at the bottom by a brass slide in which two ½-inch coverslips are mounted, thus enabling a known volume of cloud to be trapped in an air-tight space. The coverslips are slipped into holes in the underside of the slide and lie almost flush with its upper surface, being pressed firmly against a narrow rim at the top by means of ebonite disks held in position by swivel springs. The instrument may be operated either directly by hand or indirectly from outside a dust chamber. In the first instance it is waved, with the axis of the cylinder vertical, up and down through the air; when a representative sample of air has been entrained the lid and slide are pushed over the ends and the cylinder left in a vertical position one to three hours. In the second instance the instrument is fixed in the dust chamber to permit free access of air to the cylinder, and the dusty air is circulated through it by an electric fan placed horizontally underneath. The lid and slide are pulled into place from outside the chamber by suitable strings. The lower limit of particle diameter detectable by this method is about .2 micron.

Green[97] emphasizes that the methods described are intended for research, for measurements of dust in fairly high concentration, not for routine or long-period estimations. The methods also provide a simple and accurate means of testing in the laboratory the efficiency of dust-sampling apparatus. They are most suitable for clouds containing not less than 1,000 particles per cubic centimeter, although they can be extended to clouds containing not less than 100 particles per cubic centimeter; they cover the whole size range down to .2-micron diameter. Green also describes methods for counting the particles under a microscope of high resolving power and for determining rapidly the size-frequency of particles by a comparator.

In an article on recent developments in methods of sampling dust Green[64] said that it is somewhat disconcerting to find in the literature dealing with the hazard due to mineral dusts a general lack of information about the intrinsic nature of the dusts as they exist in the air. He attributes this to the lack until recent years of accurate methods for gaining this information, although it is true that many data have been accumulated as a result of determinations with field instruments, but the value of these figures must be discounted owing to inherent defects in the instruments themselves. He gives a critical review of the available instruments and a method of testing them, including a method of generating in the laboratory dust clouds similar to those found in industry. Three types of instruments were selected for testing—the Greenburg-Smith impinger, the "standard United States instrument"; the konimeter, in general use in South Africa; and the Owens jet dust counter, often used in England and many other countries. He concludes that none of these instruments would give accurate data about either the number or size-frequency of particles in dusts, nor could they be used for fundamental work, and for comparative work they would need very careful preliminary calibration in the laboratory against dust of similar character to those found in the industry under investigation. He and his co-worker Watson developed a modified thermal precipitator which they claim satisfies most of the requirements of a standard instrument for both fundamental and comparative work; it yields accurate information about the number of particles and their size frequency and, to a certain extent, about their shape. A fundamental investigation would also require that the nature of the particles be determined quantitatively; the thermal precipitator records can be mounted for petrological examination, but owing to the difficulty of identifying the nature of particles below about two microns in diameter this part of the problem still awaits solution.

Electrostatic Methods: The fact that electrically charged bodies in an electric field tend to migrate to one of the electric poles has long been known[74]. This principle of the precipitation of suspended matter by electricity has been applied commercially to the collection of industrial dusts by Cottrell[98], who reduced to engineering practice the fundamental processes developed by earlier investigators; adaptation of the Cottrell process to determination of dust in air is under consideration by engineers interested in dust control. In 1919 Bill[99] reported the use of the electrostatic method for sampling dust in air. The essential feature of this instrument is a collecting electrode, consisting of a metal tube, and an ironizing elctrode. The dust particles are charged by the ironizing electrode and travel to the collecting electrode, where they are deposited. The collection system, however, is only a small part of the complete apparatus. In addition, it includes a high-tension transformer, a rectifying device for the high-potential alternating secondary current, a source of alternating current to excite the transformer, and a pump or fan for passing the air to be studied through the electrically charged field.

In 1923 Drinker, Thomson, and Fitchet[100] described a greatly simplified form of electrostatic apparatus having a dust-removal efficiency of nearly 100%. In 1925 Drinker and Thomson again simplified this apparatus[101]. Current is supplied by four alkali storage cells, from which both the precipitator and suction-fan motor derive the necessary current. The entire apparatus weighs approximately 13 pounds and appears to be an instrument with considerable practical application[74].

Resistance: This method makes use of the fact that the resistance of a filtering medium increases as its pores become filled with dust. The apparatus, known as the "Anderson and Armspach Dust Determinator"[101], consists of a holder in which a piece of filter paper or other porous fabric is clamped. Air is drawn through the paper at a constant rate and the difference of pressure between the two sides of the paper is determined by a "U" tube, the arms of which open into the holder, one on each side of the paper. The panometer reading indicates the difference of pressure existing between the two sides of the filter. As the paper clogs more pressure is required to keep the air passing at the same rate, and the manometer reading increases. This instrument was developed for use in testing air washers by the research laboratory of the American Society of Heating and Ventilating Engineers. It has no hygienic purpose because it gives no information on particle size and quantity of dust encountered. The correlation between the actual dust content of the air and the resistance to passage through a filter paper would entail considerable time and arduous labor, if it could be done at all.

Impinging Methods: Another method impinges a definite sample of air on a prepared surface. This aparatus has the advantage that a definitely known volume of air is sampled, and by the velocity of the impact a greater percentage of the dust is caught and may be estimated. Numerous variations of impinging the air on prepared surfaces have been developed, most of which have not been highly efficient.

Konimeter: In 1916 Kotze[106] called attention to an instrument which he called the konimeter. This consists of a chamber, one side of which is a vaseline-coated glass plate, and an impinging orifice, which is perpendicular to the slide. The air is sucked out of the chamber by a cylinder and a spring-actuated piston. The only means of ingress of air is through the impinging orifice, and when the air enters the chamber at high velocity in this manner the dust is deposited in the form of a spot on the greased plate. The dust may be counted under the microscope, using a ruled eyepiece. The method of examining konimeter dust spots by opaque illumination, as practiced until recently in South Africa[96], not only gave unreliable but also misleading results and has been replaced by examination of the dust spots under transmitted polarized light.

Hill dust counters: Hill[68] devised two forms of dust sampling devices that use the impingement principle. The first, the photographic dust counter, consists of a metal frame supporting a metal funnel at one end and at the opposite end a photographic plate holder. An anemometer is placed in the funnel-shaped opening and a moistened photographic plate in the plate holder at the opposite end. Air is forced through the anemometer against the plate. After the usual photographic development the particles on the plate may be counted directly, or a print may be made and the particles enumerated. This method obviously has the same disadvantages as the other low-velocity impingement methods, to which is added the error introduced by the use of the photographic method.

Hill's[68] second instrument of the impinger type consists of a hand-actuated piston moving in an air cylinder, the only inlet to which is a nozzle one eighth inch in diameter. In front of this nozzle and fixed only a short distance from it is a microscope cover coated with an adhesive

preparation. When the piston is drawn out a jet of air is impinged on the prepared slide, which catches the dust. By using six slides in series Hill found that the first slide caught only 62% of the dust. He assumed, however, that all the dust was caught by the six slides, an assumption considered fallacious. This instrument is similar to the Kotze konimeter.

Comparatively high velocity is necessary for deposition of dust in this manner.

Impinger dust-sampling apparatus: In a comparative study by the United States Bureau of Mines and the United States Public Health Service [104] the duct-catching efficiency of the impinger was found to be high. Consequently its physical principles and characteristics were made the object of a special study; as a result a relatively satisfactory and fairly practical form of dust-sampling instrument, based on this principle, has been evolved[105]. This device has the advantage of high dust-catching efficiency when air is sampled over the full range of dustiness (from relatively pure outdoor air to that found in very dusty coal-mining operations) at the relatively rapid rate of 28.3 liters (1 cubic foot) per minute. The dust is caught in a liquid medium in which it may be counted and analyzed microscopically, gravimetrically and chemically (provided it is insoluble in water). Three forms of the instrument are described: Electrically driven, compressed-air-driven, and a hand-actuated form. While using the impinger apparatus in a study of the hazards of rock drilling on building and subway construction work about New York City Fehnel[70] experienced difficulty in checking with the empirical method found effective by the United States Public Health Service in its study of the granite industry. He consulted other technicians and found that some modified the light by tilting or shading the mirror; he therefore tried a modification of the illumination. Other investigators, manufacturers of microscopical equipment, and microscopists who were consulted agreed that the standard procedure did not reveal the small particles, and the use of dark-field illumination was essential. Various combinations of magnifications and dark-field illuminations were demonstrated at Saranac Lake in April, 1932, using a specially prepared silica dust of three micron average size. It was decided at that time that the various agencies interested would employ both light and dark-field methods in studying various industrial dusts. So far, according to Fehnel[70], no attempt has been made to correlate the findings collectively. Two comprehensive studies employing both methods of counting showed a fair, consistent relation between counts on the same types of dust, so that it is possible to establish a conversion factor. The modified method has proved that technicians can check fairly consistently their own and others' counts on the same samples; moreover it reduces materially the time element necessary.

Fehnel[70] also calls attention to the value of determining particle-size measurements with dust counts. His first method employed the filar micrometer, using a dry preparation made by evaporating the sample collected in the impinger and examining under oil immersion. As such a procedure is very laborious, Green's method[106] of determining the particle size of paint and rubber pigments was adopted; this method requires more operations but eliminates the possibility of becoming mechanical when doing routine work, as is the case with the filar micrometer. It also speeds up materially the work of particle-size determinations. The percentage frequency of occurrence is plotted against particle size on Hazens' logarithmic paper, so that the curve comes out a straight line, which makes it easy to interpolate. Fehnel[70] states that the interesting facts found so far on particle sizes are that the median or 50% of the industrial dusts studied are in the one- to three-micron size range and that 90 to 99% are less than 10 microns.

According to Hatch and Thompson[107], the impinger technic has provided valuable assistance in the study of the dust hazard, but because of the considerable amount of apparatus involved and the skill required in the quantification of samples it is not entirely satisfactory for routine plant control. Given a standard of permissible dustiness with a reasonble factor of safety, it may even be sufficient for routine plant control to know whether the dustiness associated with a particular process is above or below the standard; the ability to obtain this information quickly is more important than the accuracy of the determination. As Mavrogordato[63] has pointed out, the plant operator does not want precise dust counts but rather data on which he can act. Because of the skill required in operation of the apparatus or in "quantification" of samples or because of other undesirable characteristics, the impinger, direct-vision konimeter, and other rapid methods of dust determination were not considered entirely satisfactory for the average industrial plant. A new method developed by Hatch and Thompson[107] appears to have many desirable features with respect to simplicity and rapidity in operation. An Owens counter, modified to permit collection of eight samples direct onto a single glass slide, is used as the sampling instrument, and the "dust ribbons" are quantitated by matching against a series of standard ribbons under a comparison microscope. The method is calibrated in terms of the impinger. It is intended for rapid, approximate dust determination only and is not proposed as a substitute for the impinger. It must be calibrated at the outset against that instrument, and the relationship should be checked from time to time. Data obtained with the Owens counter alone should not be regarded as constituting complete "legal" evidence of dust concentrations. As an adjunct to the impinger it may be used to measure the efficiency of dust-control equipment.

Modified Zeiss konimeter: Since dust diseases are due to the physical or chemical action of certain dusts below a specific fineness it is desirable to measure independently the content of the finest dust particles in suspension in air without at the same time being burdened by the coarser and relatively harmless grains. This principle of selective dust estimation has been applied in the Zeiss konimeter[108]. In this apparatus a sample of air is taken and all dust particles above a certain size are removed by filtration; the finest particles remaining in suspension are then deposited on a slide in the usual way. The apparatus consists of the standard Zeiss konimeter, supplemented by a special air filter, and a small pump to aspirate air through the konimeter. The air enters the sampling unit at the filter, which contains a number of glass beads, and passes through a narrow jet. The sampling disk is the same as in the original Zeiss konimeter, a glass disk secured in a ring, which can be turned about the konimeter to the 30 sections on the slide opposite the sampling jet in succession; up to 30 individual samples can thus be taken without dismantling or readjusting the whole apparatus. The electric motor is of standard design and can be run from batteries or from a direct-current supply.

The dust samples are examined in the usual way under a microscope, all particles being visible at the outset. After a preliminary examination a drop of tetralin added to the sample renders the quartz particles invisible, as their refractive index is virtually identical with that of tetralin. By a differential count it is possible to estimate the quartz content of a dust sample. The article mentions that this apparatus has been exhaustively tested in various dust researches in Europe and found to give reliable and reproducible results.

Comparative tests made with the Kotze and Zeiss instruments[109] under identical conditions revealed that the Zeiss has an efficiency 50% higher than the Kotze; therefore, in making determinations with the Zeiss konimeter the limit of safe concentration is increased from 300 to 450 particles per cubic centimeter.

Photometric estimation of konimeter dust samples: In November, 1934, Franks and Tresidder[110] described a rapid photometric method of estimating the dust collected on treated konimeter slides; this method retains all the advantages of the konimeter and at the same time overcomes certain disadvantages—notably, those associated with counting the material in the dust spot. Counting is arduous and time-consuming; photometric estimations can be made in about one tenth the time required to count an average spot. Furthermore, according to Frank and Tresidder[110], the counting method is a purely arbitrary measure of the dangerousness of dusty air; equal value is placed on each particle, regardless of its size or siliceous nature. The photometric values are most sensitive to the size range that is most dangerous; this method also tends to differentiate the particles by giving high value to quartz and largely obviates errors in counting due to sector sampling, aggregation, fatigue, and personal error. The estimable range of dust concentration

is extended to include dust concentrations found in blasting. Such a method should readily give data which, when correlated with clinical findings, should lead to a better identification of the dust hazard.

Physiological Methods: In addition to the above methods of determining the quantity and composition of dusts that occur in many industrial occupations it is important to distinguish those capable of causing pneumoconiosis. The obvious way to determine whether a substance can affect the human lung is to test its action on the lungs of animals, but according to Kettle[111], this method is not altogether satisfactory as it is laborious, expensive, and, above all, time-consuming. Whatever the technic employed for the introduction of dust into the lungs, all who have worked on experimental pneumoconiosis agree that the end lesion—the characteristic fibrotic nodule—cannot be produced in a few days or weeks but only in periods measurable in years rather than months; the method therefore has little value as a practical test. Kettle[111] divides the constituents of occupational dust into two groups—the active and the inert—according to their behavior when injected into the subcutaneous tissues; this grouping corresponds with clinical and industrial experience. The active dusts cause an acute inflammation with necrosis of tissue and subsequent fibrosis, whereas the inert dusts give rise to nothing more than a mild and transient reaction. Further, if animals in which such lesions have been produced are infected intravascularly with tubercle bacilli clear evidence is obtained that the active dusts determined a local settlement and proliferation of the bacilli out of all proportion to that seen in the tissues generally and in the reactions surrounding the inert dusts. This technic provides a method for testing the capacity of a dust to modify an infection; however, Kettle[111] states that the claim that it tells whether the same substance can produce fibrosis of the lung is perhaps less legitimate, as there is an obvious difference between the injection of a substance into the tissues, with all the trauma involved, and its introduction into the lungs by the natural routes. He has found, however, that particulate matter suspended in normal saline may be injected directly into the lungs through the trachea without producing undue trauma to the pulmonary tissues. Particles introduced into the lungs in this way are picked up by phagocytes just as are the particles of dust inhaled in the air, and in due course some of the dust containing phagocytes reach the extrapulmonary lymph nodes. In human silicosis the earliest lesions are found in the root glands as the result of this process; the same is true in experimental pneumoconiosis. It does not matter how the dust reaches the lungs; although the mode of introduction possibly may have some relation to pulmonary lesions obviously it can have no influence on the glandular deposits produced entirely by natural means.

Kettle[111] found in his experiments a striking difference in the reactions occurring in the extrapulmonary lymph nodes according to whether the material introduced into the lungs was an active or an inert dust. If the injected dust was inert it remained in the substance of the pulmonary lymph nodes without causing tissue reaction and without exciting the attention of other phagocytic cells. If the dust was active, as soon as it was liberated by the death of the phagocyte it was ingested by fresh cells which appeared in such numbers as to disorganize completely the structure of the node. This activity was progressive and eventually led to the formation of the characteristic acellular nodule, although it might take a year or more. However, Kettle found it was necessary to wait for the end lesion to form in the lymph nodes before he could reach a conclusion regarding the nature of the dust; within three months a microscopic examination revealed such significant changes as to make diagnosis possible. The **Colliery Guardian**[112] points out that application of the method on a large scale might result not only in a definite preliminary classification of dusts but in the establishment of standards by which any samples could be tested.

In an investigation of the cellular response of lymph nodes to various dust suspensions introduced into lymphatics Stuber[113] found that cellular response of the lymph nodes to the injection of dusts containing considerable free silica is essentially different from that to other particulate material, the latter being phagocytosed only by normal lymph phagocytes. Some silicates produced a stimulation at the beginning with later slight changes in the cytoplasmic structure of the host cells. He described the response of the phagocytic system of lymph nodes to the injection of silica and the characteristics of the silica-containing phagocytes; these are identified biologically as modified endothelial lymph phagocytes. The silica-containing cells lose much of their phagocytic power toward other particulate matter. Phagocytes that answer the description of the silica-containing cells in lymph nodes as produced in these experiments could be found in air spaces in cases of experimental as well as industrial silicosis of the lungs. It appears possible that the lymph-node injection method may be developed into a rapid means of determining the toxicity of certain dusts.

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"IT SHALL be the duty of the Division to investigate conditions of occupation with reference to hazards to health and to determine the degree of such hazards, to investigate and evaluate methods for the control of such hazards to assist in the preparation of rules and regulations for the preventing of occupational accidents and diseases, and, in cooperation with the department of public health or otherwise, to promote occupational health and safety education."—Sec. 11A of the law creating the Division, effective 1934.

Employee Selection

THE various economic security plans will still further magnify the importance of careful selection. This will tend to widen the gap between available jobs and those unemployed. This tendency to increase the number of unemployables will create a problem of great interest and importance to society. Industrial management will not be responsible for this situation, but it must take note of this problem because of its effect on public attitude."*

Advisory Medical Committee

NORTH CAROLINA'S Governor Ehringhaus has appointed an advisory medical committee to the state industrial commission in accordance with the amendment to the state workmen's compensation law making occupational diseases compensable. Dr. Samuel B. McPheeters, Charlotte, is chairman, and Drs. John Donnelly, Huntersville, and Gibbons W. Murphy, Asheville, are the other members.

*A. B. GATES, Director of Training, Eastman Kodak Company, addressing Industrial Relations Association of Chicago, June 17, 1935.

New Books

THE PNEUMONOKONIOSES (Silicosis) Literature and Laws of 1934. By Geo. G. Davis, M. D., F. A. C. S., Ella M. Salmonesen and Joseph L. Earlywine. Chicago Medical Press (Not Inc.), Chicago. Cloth; 490 pp.

THE month of August, 1935, may be remembered, by certain medical circles, at least, because it was at this time that the second volume of a series, bearing the above title was released.

Similar to Volume I, which covers bibliography and laws previous to 1934, but with improved type and make-up, Volume II represents as the sub-heading states, "International Abstracts, Extracts, and Reviews of the Pneumonokonioses and Their Associated Diseases and Subjects." Part I contains the abstracts, extracts and reviews, while Part II is a supplement on the laws according to states and cases.

The book is dedicated to Dr. E. R. LeCount (who wrote the preface to the first volume) and whose recent passing is a distinct loss to the science of pathology and its teaching in medical schools.

The authors, Geo. G. Davis, M. D., F. A. C. S., Ella M. Salmonsen, medical librarian, and Joseph L. Earlywine, attorney, have arranged the material of the abstracts in alphabetical order, both for subjects and authors, the abstracts being numbered in order. As an accessory to the use of these numbers, there is an author index and also a comprehensive subject index. In addition to these features, the references omitted from the first book published in 1934, are also included in alphabetical order.

Completing the book in a digest of statutes and of cases pertaining to the laws on occupational diseases, bringing up to date the previously published material in Book I and arranged in alphabetical order by states.

Not only is it possible to follow work which has been completed and published in the United States, but also the abundant number of foreign abstracts is a most welcome addition to the volume, permitting the reader to get the point of view of foreign investigators.

The progress of research and investigation can well be measured by the reading of the various abstracts and by following the work of Drinker and his associates at Harvard; Gardner, Cummings and Sampson at the Saranac Laboratory; Sayers, Jones, Bloomfield, Dallavalle and others in the U. S. Public Health Service, Yant and Harrington at the U. S. Bureau of Mines; Lemon and his group at the Mayo Clinic; the work of Lanza, McConnell and Fehnel in the Industrial Hygiene Division of the Metropolitan Life Insurance Company; Gray and his group in the Bureau of Occupational Diseases of the State Department of Health of Connecticut; the work of the Bureau of Occupational Hygiene of the State Department of Labor of Massachusetts, under the direction of Bowditch; McCann and his associates at Rochester University; Pancoast and Pendergrass at the University of Pennsylvania; Meiter, with the Employers Mutuals of Wisconsin —and the independent and unattached workers in this field. Interesting also are the names attached to foreign literature, among them very prominent persons who have engaged in research or statistical analyses for many years, such as Badham, Collis, Cooke, Cummins, Gloyne, Green, Gudjonsson, Haldane, Irvine, Jotten, Jones, Kettle, Legge, Middleton, Moir, Owens, Policard, Riddell, Stewart, Watkins-Pitchford Wood, and others, of equal prominence, too numerous to include here.

In reading the various abstracts, one cannot help but be impressed by the great "stir" which was created by the announcement of the Jones sere-cite theory—many pages are devoted to the discussions and criticisms of this point of view; and if Jones has done nothing else for the problem of silicosis, certainly he has incited to action the though complex of many investigators and further research into the important problem of etiology, although the theory probably is still unaccepted by many authorities.

Equally prominent, as one reads, is the impression that there is a great deal of confusion in international literature at the present time regarding the various phases of silicosis and its related conditions. Contradictions are numerous (which is not due to the interpretation of the compilers or abstractors, but to scientific disagreement). This is not a discouraging sign, but rather one of healthful skepticism such as accompanies all scientific progress, and is not limited

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The Program

Will include papers and reports on:

"Respiratory Disease due to Dust among Anthracite Miners",

"Practical Aspects of Occupational Diseases and their Prevention,"

"Industrial Medical Service in the Telephone Industry",

"Industrial Hygiene Instruction",

"A Program for a National Institute of Occupational Diseases".

Scientific committee reports will include Skin Irritants, Pneumonoconiosis, Ventilation and Atmospheric Pollution, Lead Poisoning, and Standard Practices in the Problem of Compensation of Occupational Diseases.

Benzol Poisoning, Lead Poisoning, Pulmonary Asbestosis and Dust Determinations will also be discussed.

The Speakers

The following well-known names appear on the program:

Dr. J. A. Britton, Supervisor of Medical Service, International Harvester Company,

Mr. J. J. Bloomfield, of the United States Public Health Service,

Dr. C. O. Sappington, Consulting Industrial Hygienist,

Dr. Edward S. McSweeny, Medical Director of the New York Telephone Company,

Dr. Emory W. Sink, Assistant Professor of Hygiene and Public Health at the University of Michigan, and

Dr. Henry H. Kessler, Medical Director of the New Jersey Rehabilitation Commission.

The Audience

Industrial physicians, directors of industrial relations, industrial nurses, industrial hygienists and others concerned with medicine and hygiene in industry.

An Invitation

The readers of this magazine are cordially invited to attend the Milwaukee sessions, the week of October 7, and participate in the discussions.

The Chairman and Secretary of the Industrial Hygiene Section will welcome your inquiries.

HENRY H. KESSLER, M.D., Chairman
Medical Director, N. J. Rehabilitation Commission.

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N. Y. Tuberculosis & Health Assn.,
386 Fourth Avenue, New York City.

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to the problems of silicosis—for there are many fields in which the differences are of equal or greater magnitude. Disturbing as this may be to the unqualified reader whose personal experience has not been of sufficient latitude to permit him to make discriminating selections, there is running through the abstracts an international background of solid scientific opinion and judgment, which is of inestimable value.

The compilers and abstractors have proved beyond question that abstracting is as much an advanced art as writing; subtlety of expression, humorous allusions, ironic appraisal of style, and the fine ability to discriminate with keen-edged insight between the real and the apparent combine to make the reviews a real collection of the "fine are of abstracting," and appealingly readable and entertaining, as well as instructive.

Newspaper clippings have also been given their place in this series of reviews; particular attention is called to litigation in these notices, but many of the cases obviously have not been reported, because they did not get into the press. This, of course, was not the responsibility of the compilers. Very often such press notices give a rather distorted view of actual situations, but this can be of great value to the industrialist, as well as to professionals who are interested.

Dr. Davis, Miss Salmonsen and Mr. Earlywine are to be congratulated on assembling, for the first time in the English language, international abstracts completely covering a year of the literature of one medical subject—in this instance the literature of the year 1934, in the field of silicosis and allied dust problems.

This compilation will be of great value to all who have to deal with such situations, but especially to those whose duty and responsibility it is to keep pace with the contemporaneous literature and adapt it practically to their work.

The book contains 490 pages, of easily readable type, with the references well separated, and indexed. The pre-publication price in $7.50 until November 1, 1935, the regular price being $10.00.

—C. O. Sappington, M.D., Dr. P.H.

THE Crippled and the Disabled, by Henry H. Kessler, M.D., Medical Director, New Jersey Rehabilitation Commission. Columbia University Press, 2960 Broadway, New York City. 337 pp. $4.00.

IT VERY often happens that a skilled technician produces excellent scientific works. Many times also psychologists and sociologists produce excellent treatises without the pale of scientific technology. It is only an occasional event, however, that the skilled technician is able to combine his scientific experience with a socio-economic point of view. This Dr. Henry H. Kessler has achieved in a striking way in his book "The Crippled and The Disabled."

The principle of the entire dissertation is a refutation of the popular fallacy that all persons who are disabled and contribute disproportionately to our national economic waste, cannot eventually become self-sustaining. Dr. Kessler ably points out the methods which have been successfully used in the rehabilitation of such individuals, drawing from his extensive experience as Medical Director of the New Jersey Rehabilitation Commission.

A glance at the table of contents discloses discussions on the social attitude toward the disabled—the problem of the disabled—the child cripple — the industrially disabled — the war-disabled — the chronically disabled—and those disabled by defects of special senses. Particular attention is paid to legislative measures, including foreign legislation; vocational training; medical and hospital care; employment schemes; compensation provisions; and vocational rehabilitation legislation as a special procedure.

Tabular data are given regarding the number of crippled persons — causes of disability — estimated cost and economic saving as a result of disability—results of rehabilitation, education, and placement—disability rates — medical services — types of training and types of industry—education qualifications and earnings, and various other important conditions on which statistical data are available.

An appendix adds valuable material on "Compensation provisions for

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second major injuries in those states not having second-injury funds"—"Summary of vocational rehabilitation legislation by states"—and "Legislation for the blind." An excellently arranged and extensive bibliography completes the volume.

The author states the problem very succinctly: "The problem of the crippled and the disabled in the United States is one of vocational maladjustment. This maladjustment is due in large part to social prejudice. This discrimination can be overcome by education and propaganda and by the extension of existing legislation, which contains all the essentials of a program meeting the needs of the disabled.

"The problem of the vocational adjustment of the disabled must be looked upon as a whole. Hence uniform administrative control is required. This has been achieved by the enactment of legislation in the United States creating state rehabilitation commissions cooperating with the Federal government.

"This same problem must be seen in the light of the needs of three distinct groups; those who are or may become totally productive; those who are or may become partially productive; and those who are or may become totally unproductive.

"The first group must be visualized as a group who are unemployed because of social prejudices. The second are unemployed because they do not meet the vocational requirements of industry; while the third group cannot be looked upon as a problem of vocational maladjustment, but rather as one of dependence. The needs of each group are special and must be met by special methods.

"To satisfy the needs of the totally productive group, existing legislation must be supplemented by compulsory employment legislation or by unemployment insurance. For this type of legislation no precedent exists in American experience, and foreign legislation must be turned to for guidance. Civil service preference legislation for disabled veterans may be regarded as establishing this principle in America.

"To satisfy the needs of the partially productive, it is necessary to establish sheltered workshops that are subsidized by the government. A precedent exists in the industrial workshops that are set up for the blind.

"The problem of the totally unproductive is not that of vocational maladjustment, but of pensions. Precedents for these measures are found in old-age pensions, in mothers' aid pensions and in pensions for the blind.

"In addition to these more or less specific requirements, there is need for the removal of restrictions against disabled persons in governmental positions . . . ."

This work will be of great value to all those who have to deal with problems of the disabled and their rehabilitation; this group includes a wide variety of persons, such as legislators, members of industrial commissions, physicians and surgeons, industrial executives, personnel directors, safety directors, supervisors, attorneys, sociologists, psychologists, statisticians, insurance companies and personnel, as well as many others.

—C. O. Sappington, M.D., Dr. P.H.

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